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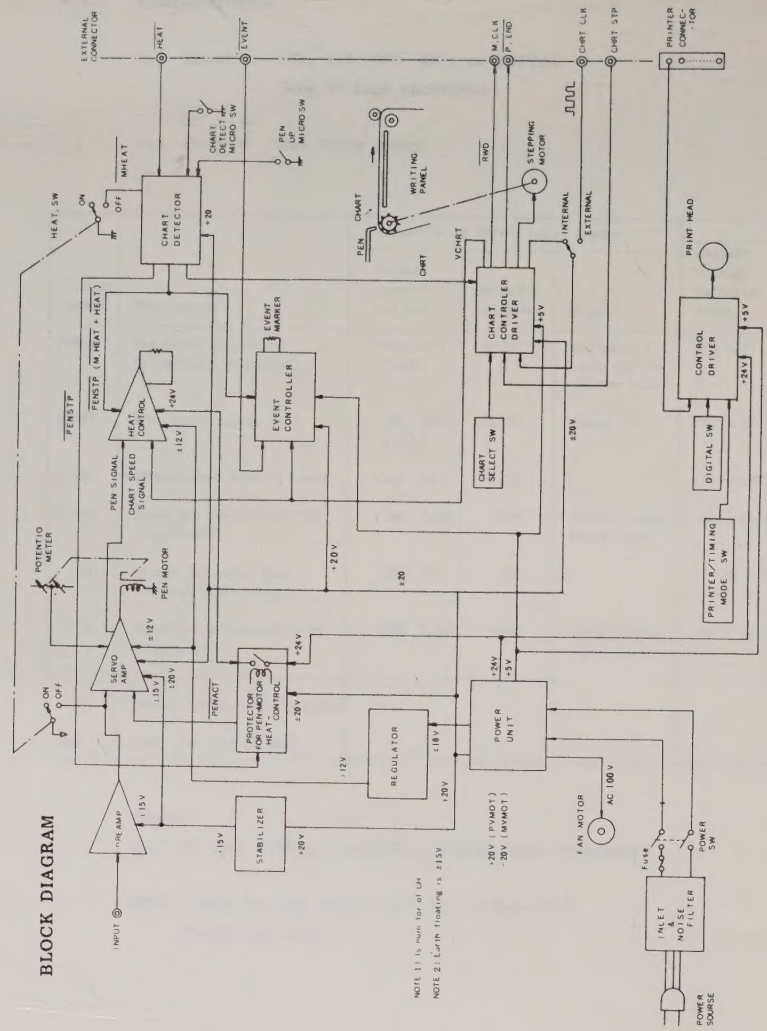
1. BLOCK DIAGRAM



2. DESCRIPTION OF OPERATION

2.1 Power Unit

2.1.1 Outline

For 8-channel units and below, this unit includes one transformer, while for the 12-channel unit, it consists of the 8-channel and 4-channel power supply units combined. This provides only the ground power supply. The AC input is specified as either 100, 115, 200, 220, or 240V, with the transformer being different for low (100V) and high (200V). The output of the unit is connected to the Mother Board, and fed to the other units through the Mother Board.

2.1.2 Characteristics

(a) Input 100, 115, 200, 220, or 240VAC
(one voltage specified)

(b) Output See Table below.

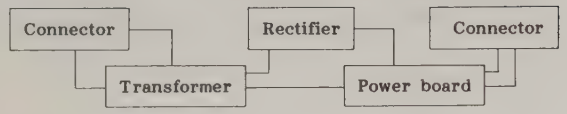
Circuit symbol	Description	Condition at 100VAC input Loaded			Loaded voltage variation range
		Output specifi-cations	Unloaded voltage	Ripple	
PVMOT	Pen motor supply (+) Pulse motor supply (+)	+16V 10A (+20V)	22.5V	Halfwave capacity: up to 10A load	+16 ∿ 23
MVMOT	(Pen motor supply (-))	-16V 10A (-20V)	-22.5V	3Vp-p	-16 ∿ 23
+24	(Thermal pen & print head)	+24V 5A	24.7V		+21 ∿ 24
+18	(Used for 3-terminal +12V regulator)	+18V 0.5A	26V	2.7Vp-p with 400mA load	+19 ∿ 23.5
+5	(Input for paper feed control logic input)	+5V 1A	5V		2%
-18	(Used for 3-terminal -12V regulator)	-18V 0.5A	-26V	2.7Vp-p with 400mA load	-19 ∿ 23.5
GND	(PVMOT, MVMOT, and +24 GND)				
SGND	(+18, -18, and +5 GND)				

(Note)
The +5V and +24V are stabilized using series regulators.

100V: Used for fan drive (+5V fan used in the 4-channel unit)

2.1.3 Configuration

The designation of the power board is 'POWER BOARD-X', where 'X' is 8 for the 6-channel and 8-channel units and 4 for the 4-channel unit. This board includes smoothing capacitor, rectifier, +5V and +24V 3-terminal regulators, and other components.



2.2 Mother Board

2.2.1 Outline

The Mother Board receives power from the power unit and performs the following functions.

1 Provides power to the various units and signal exchange using a printed circuit.

2 Prevents pen motor runaway when power is switched on and off.

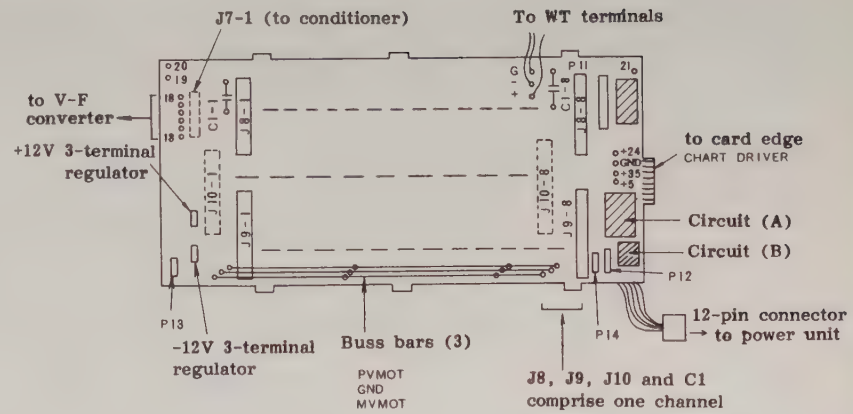
3 Provides a protective circuit which prevents excessive voltage from being applied to a thermal pen.

4 During slow-speed paper feed operation, provides a clamping circuit which prevents more than a certain level of power from being applied to a thermal pen.

Since the instantaneous motor current is 2A for each channel (16A for the 8-channel unit); it is passed through a buss bar.

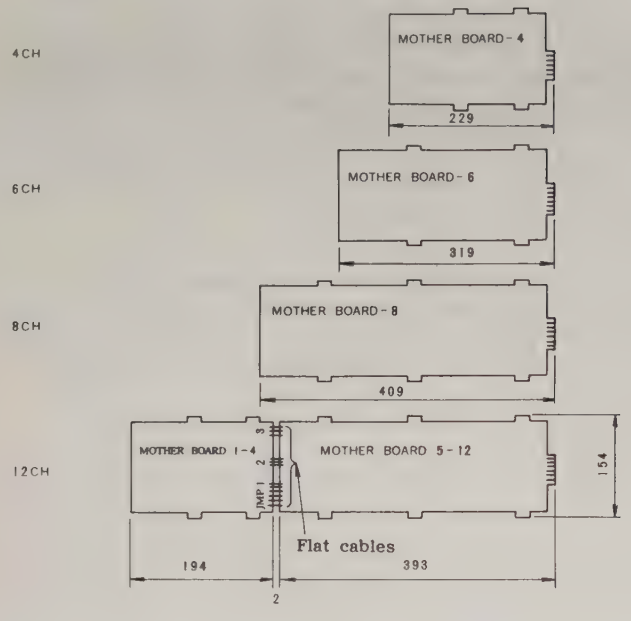
2.2.2 Configuration

(a) Basic Configuration



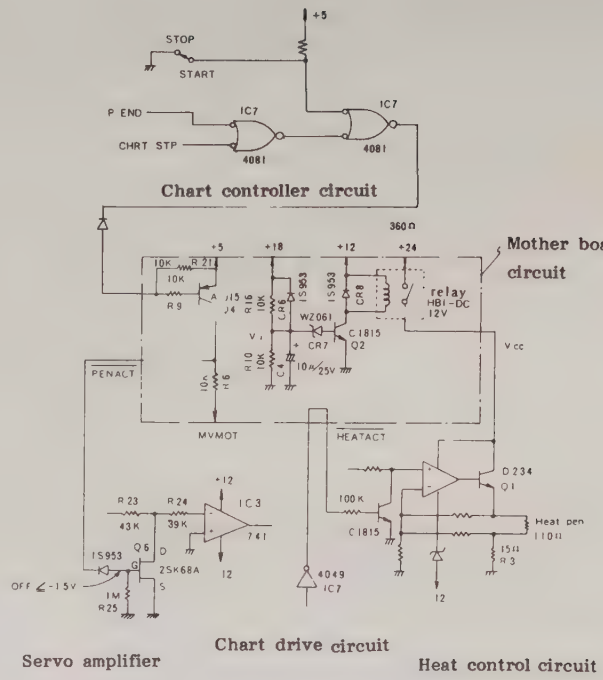
8-Channel Mother Board Parts Location

(b) Differences in Configuration by Number of Channels



2.2.3 Operational Description

(a) Circuit (A)



When the power is switched on and off, the voltage at various points in the circuitry is not the normal value but exhibits a transient condition, so that power will be applied to the pen as if it were being driven. To prevent this, and to prevent pen runaway, circuit (A) is used.

Signal name		Operational conditions
$\overline{\text{PENSTP}}$	Input	When at high level, the pen motor operates. When at low level, no torque is applied by the pen motor.
$\overline{\text{PENACT}}$	Output	At -1.5V or below, the pen motor operates. At above -1.5V, no torque is applied by the pen motor.
$\overline{\text{HEATACT}}$	Output	At 0.6V or below, the thermal pen can write. At above 0.6V, the thermal pen cannot write.

The pen runaway drive circuit receives the chart drive circuit signal ($\overline{\text{PENSTP}}$) under normal conditions and applies 0V to the pen motor drive circuit input terminal under the following conditions.

1 When the paper feed switch is at STOP.

2 When there is no more paper remaining.

3 When the pen lift lever is up.

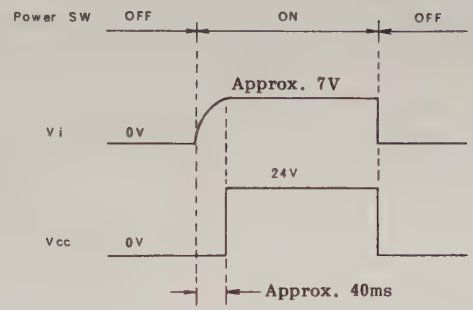
o Operation of the Pen Motor Protection Circuit

When the gate (G) voltage of the 2SK68A (FET switch) in the servo amplifier is -1.5V or below, this switch is in the OFF state, and the pen motor operates.

When paper runs out or when the STOP switch is pressed, transistor Q_4 turns ON, and $\overline{\text{PENACT}}$ goes to approximately +5V. Thus, FET switch Q_6 turns ON, the input to IC3 falls to ground potential, and the pen motor is in the free state.

o Operation of the Thermal Protection Circuit

At the instant power is applied, the thermal pen power supply V_{cc} is applied. When the power is switched OFF, the +24V which was applied to the thermal pen is immediately cut off by this circuit. A relay is used for this purpose.



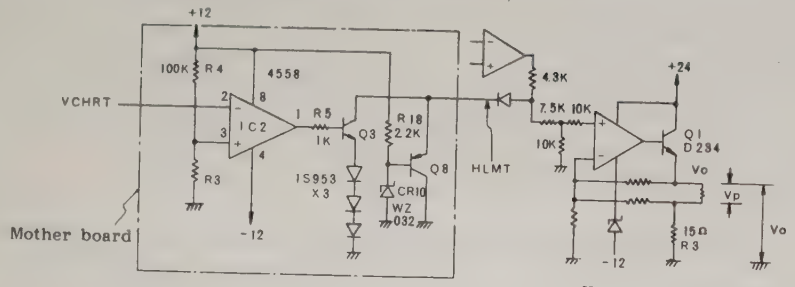
V_i increases gradually according to an RC time constant after power is switched ON. When it reaches the threshold voltage of Q_2, which is approximately 7V, Q_2 turns ON, and a relay operates, and +24V is applied.

When the power is switched OFF, discharge takes place through 1S953, so that the time constant is extremely short and the relay opens.

(b) Circuit (B)

At slow paper feed speeds, if the pen is driven at a high frequency, the recording density will increase and the thermal pen heat radiation will worsen, causing a possible shortening of the pen life.

To prevent this, when the paper feed speed is less than approximately 19mm/s, even when the pen is driven at a high frequency, the heating element voltage is clamped to 8V.



Heat control circuit

VCHRT is the paper feed speed signal and is a voltage which is proportional to the paper feed speed (250mV at a speed of 100mm/s). IC2 serves as a comparator.

With a pen is driven at several 10s of kilohertz, the limiting voltage V_p on the thermal pen is as shown below.

Feed speed	IC2 Output	Q_3	HLMT	+ Voltage on thermal pen (with respect to GND)
19mm/s or less	+10 ∿ +12V	ON	Approx. +2.3V	$V_o \cong 8V$ ($V_p \cong 7V$)
19mm/s or less	-10 ∿ -12V	OFF	Approx. +3.9V	V_o 13V ($V_p \cong 11V$)

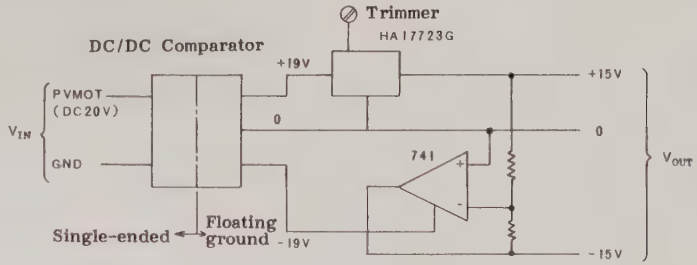
2.3 Stabilizer

2.3.1 Outline

This circuit is a regulated power supply that outputs ±15V, and supplies this voltage to the preamplifiers, servo amplifier input section, and heater (heating element) circuit pen signal input section. It uses a DC/DC converter which has a single-ended voltage (PVMOT (DC)) input, the output of which is ±19V. This is fed to a regulator IC (723) and an operational amplifier (741) to derive the output of ±15V.

A built-in protection circuit is provided so that either of the +15V or -15V may be grounded without damage. The output is floating with respect to the input.

2.3.2 Block Diagram



2.3.3 Characteristics

Item		Specifications	Remarks
Input voltage	V_{IN}	11 ∿ 24VDC (single-ended)	
Input power	P_{IN}	±45mA load: 2.8W (typical) ±5mA load: 0.8W (typical)	
Output voltage	V_{OUT}	±15V ±0.4%	
Maximum output current	$I_{OUT\ (max)}$	±45mA	With the preamplifier, servo amplifier, and heater circuit operating: +34mA, -29mA (typical).
Residual ripple		Approx. $7mV_{p-p}$ (100kHz)	With the standard load

2.4 Servo Amplifier (Including Pen Motor and Potentiometer)

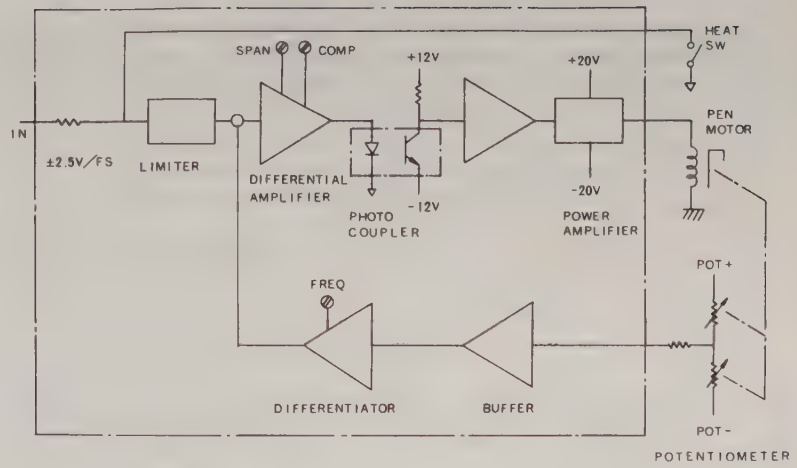
2.4.1 Outline

This circuit drives the pen motor, and features isolation using photocouplers between the input and output sections. Therefore, the three power supplies used consist of the ±15V floating supply which drives the input section, and the single-ended ±20V and ±12V supplies which drive the output section (power stage).

The input sensitivity is ±2.5V/FS, the frequency response being 70Hz (S size $10mm_{p-p}$). The accuracy is ±0.5% of fullscale.

Protective circuitry includes electronic limiting to control the pen swing angle under excessive input conditions, and an FET switch which sets the pen motor into the free state when the recording paper is rewound.

2.4.2 Block Diagram



(Note)

⊘ are trimmers.

2.4.3 Characteristics (For each channel)

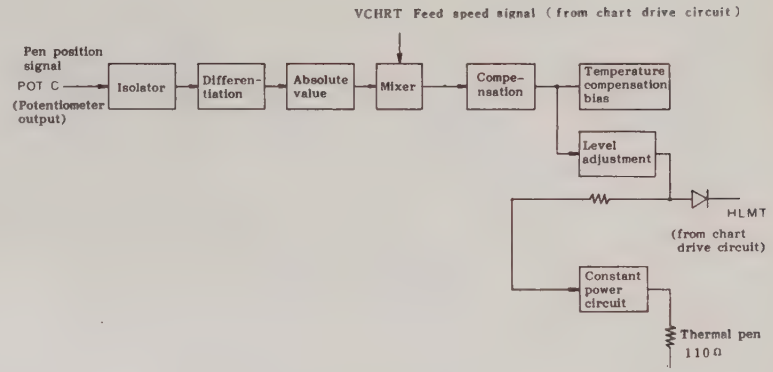
	S TYPE	W TYPE	
Power supplies used	Input section ±15V ±0.4% (+20mA, -17mA, typ.) Output section ±12V ±0.5V (±3mA, typ.)		Floating ground
	Output section ±12 ∿ 24V 40mmpp, 35Hz: ±470mA 10mmpp, 70Hz: ±550mA	Output Section ±12 ∿ 24V	Single-ended (all channels)
Recording width	±20mm	±40mm	
Input type	Floating		
Input resistance	Potentiometer		
Circuit type	Servo (isolation amplifier)		
Sensitivity	±2.5V/4cm	±2.5V/8cm	Input and output polarities are reversed.
Input limiting voltage	±2.759 ±0.4%	±2.708 ±0.4%	
Accuracy	±0.5% of FS		
Frequency characteristics	10mmpp 0 ∿ 70Hz +5% -10% 20mmpp 0 ∿ 50Hz +5% -10% 40mmpp 0 ∿ 35Hz +5% -10%	20mmpp 0 ∿ 30Hz +5% -10% 40mmpp 0 ∿ 25Hz +5% -10% 80mmpp 0 ∿ 20Hz +5% -10%	

2.5 Heat Control Circuit

2.5.1 Outline

This circuit receives the pen signal and paper feed speed signal, and controls the voltage applied to the thermal pen. The pen signal is the output of the potentiometer which is used to derive pen position information, while the paper feed speed signal is a DC voltage proportional to the paper feed speed which is received from the chart drive circuit. Therefore, operation is basically DC.

2.5.2 Block Diagram



2.5.3 Operational Description

The pen position signal is the output of the potentiometer and is floating with respect to ground. All other parts of the circuitry are single-ended. These two systems of circuitry are isolated from one another using photocouplers.

The pen position signal is converted to the speed signal and mixed with the feed speed signal, after which it is compensated. To this signal is added a DC bias voltage. It is adjusted by the heat control adjustment, and applied to the constant power circuit.

Typical values of the pen position signal and paper feed speed signal are shown in the tables belows.

Pen position signal

Pen amplitude	Voltage POTC
S Type 40mmp-p	(700±230)mVp-p
W Type 80mmp-p	

Feed speed signal

Feed speed	Voltage VCHRT
10mm/s	25mV
50mm/s	125mV
100mm/s	25mV

Other speeds and voltages are proportionally related.

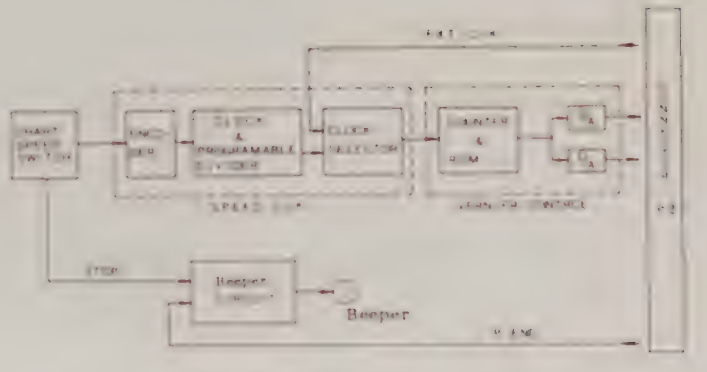
2.6 CHART CONTROLLER (PR3701-02)

As shown in the figure, the CHART CONTROLLER may be broken into the following major components.

1 SPEED CLOCK Section which determines the speed of the stepping motor.

2 VERNIER CONTROL Section which consists of a counter, control ROM, and D/A converter.

3 Beeper circuit



In this section, a clock is output according to the paper feed speed which is set by dividing a 100kHz signal by a built-in programmable divider.

(a) The frequency output by the programmable divider (pin 9 of IC5) is as follows.

SEC Feed: 200N (Hz)
MIN Feed: 3.333N (Hz)

(N is the number indicated by the pressed button. For example, for 100mm/s, the frequency would be 20kHz.)

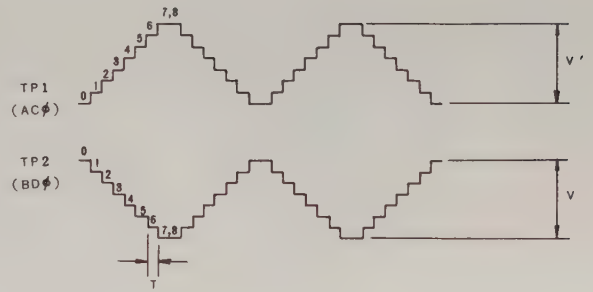
(b) The output of the programmable divider is input to a 1/5 divider (IC6), the output frequency of which is as follows.

SEC Feed: 40N (Hz)
MIN Feed: 0.6666N (Hz)

2.6.2 VERNIER CONT Section

In this section, the clock output by the SPEED CLOCK section is counted and converted to an output voltage used to drive the stepping motor. The output waveform is shown in the figure below.

(Note)
The TP1 and TP2 signals are taken with respect to ground.



V' ≅ V

T in the above waveform is as follows.

SEC Feed: $T = 0.025 \times \frac{1}{N}$ (s)

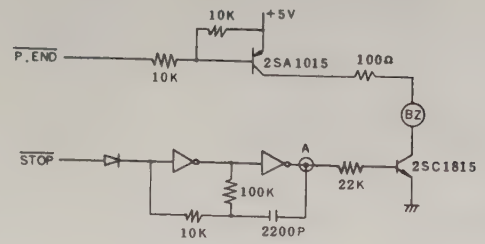
MIN Feed: $T = 1.5 \times \frac{1}{N}$ (s)

The relationship of SPEED to V is as follows.

SPEED	V
25mm/s or less	≅ 1.3V
50,100mm/s	≅ 1.6V

2.6.3 BEEPER Circuit

The oscillator circuit shown below generates a beeping sound when the pen lift goes UP and when recording paper runs out. The oscillation frequency at point A is approximately 2.5kHz.



2.7 EVENT MARKER CONTROLLER (PR3701-21)

The clock signal appropriate to the feed speed is converted to a voltage by a F/V converter on the chart driver PCB. It then passes through the chart controller PCB and is input to the event marker controller PCB.

The voltage applied to the marker (COM terminal) depends upon the feed speed and is as shown in Table I below.

On/off control of the marker is switched using the transistor array μPA53C.

Table I Marker COM terminal voltage

CHART SPEED	Marker COM voltage
10mm/s	Approx. 8V
100mm/s	Approx. 10V

Table II Signal names for the connector between the chart controller PCB and the event marker controller PCB (P3-J3)

1	PVMOT
2	+5V
3	-8V
4	EVENT
5	VCHRT
6	MARKC
7	EVENT 1
8	EVENT 2
9	EVENT OFF
10	GND

PR3701-13 CHART DRIVER Connections

A	Name	Description
1	GND	Logic ground
2	+5V	+5V Regulator voltage
3	+8V	+8V Regulator voltage
4	PFEED	0.4mm movement pulse
5	$\overline{\text{EXT}}$	Low level when EXT switch is ON
6	ACϕ	Stepping motor D/A
7	Aϕ	Stepping motor phase-switching pulse
8	Bϕ	"
9	$\overline{\text{CHRT STP}}$	Low level at EXT and CHRT STOP conditions
10	CHRT CLK	EXT, CHRT, CLK input
11	$\overline{\text{EVENT}}$	Low level when external EVENT is ON
12	MARKC	Event marker supply voltage
13	EVENT2	Event space (baseline)
14	-8V	-8V Regulator voltage
15	PVMOT	Approx. 20V unfiltered rectified voltage

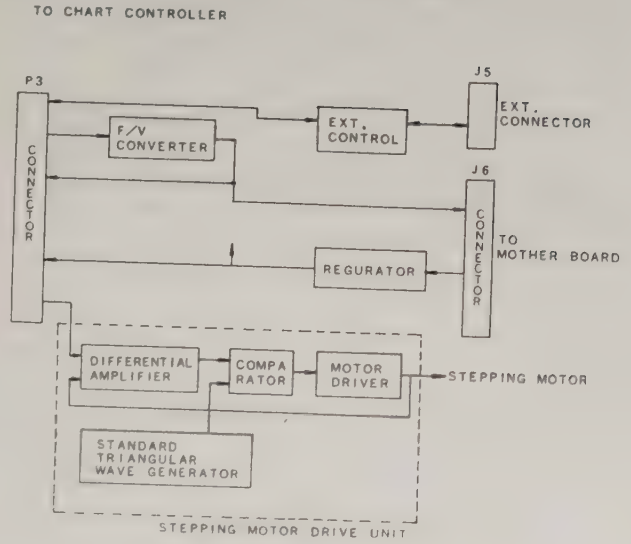
B	Name	Description
1	GND	Logic ground
2	+5V	+5V Regulator voltage
3	+8V	+8V Regulator voltage
4	MCLK	Master clock pulse used to sync other devices
5	BDϕ	Stepping motor D/A
6	Cϕ	Stepping motor phase-switching pulse
7	Dϕ	"
8	FV, PULS	V CHART F/V Pulse
9	$\overline{\text{PEND}}$	Low level at pen lift and paper end
10	$\overline{\text{HEAT OFF}}$	High level at HEAT OFF condition
11	VCHRT	Chart speed proportional voltage
12	EVENT1	Event ON (marker line)
13		Event OFF (event heat OFF)
14	-8V	-8V Regulator voltage
15		

2.8 CHART DRIVER (PR3701-13)

The CHART DRIVER can be divided into the following parts.

1 External input/output control section.

2 Stepping motor driver section.



2.8.1 EXT IN/OUT Control Section

This section controls external connector input/output.

External Connector (J5) Signal List

Pin	Name	Function	In/Out
A1	$\overline{\text{PEND}}$	Low level at pen lift or paper end	Output
A2	$\overline{\text{EVENT}}$	ON when the event marker is at low level (option)	Input
A3	$\overline{\text{HEAT}}$	Valid when the HEAT switch is OFF; heat is on at low level	Input
A4	CHRT CLK	External sync clock (valid with the EXT switch ON)	Input
B1	CHRT STOP	Chart stops when high (valid when STOP switch is OFF)	Input
B2	M,CLK	Master clock (used to sync other devices)	Output
B3	GND		
B4	+5V	(Output impedance 2.2kΩ)	Output

2.8.2 Stepping Motor Drive Section

This section is used to provide Vernier drive for the pulse motors. A 1Ω current-detection resistance (3W) is used in a constant-current closed loop circuit.

1 Differential Amplifier

This amplifier amplifies the difference between the voltage output by the D/A converter (sent from the CHART CONTROLLER board) and the voltage across the stepping motor current-detection resistance.

Triangle wave

This reference waveform is used to provide a constant switching frequency for the motor coil current. The frequency is approximately 20kHz.

3 Comparator

This comparator is used to compare the differential amplifier output and the reference triangle wave, thus establishing the switch-on time for the motor coil current.

4 Driver

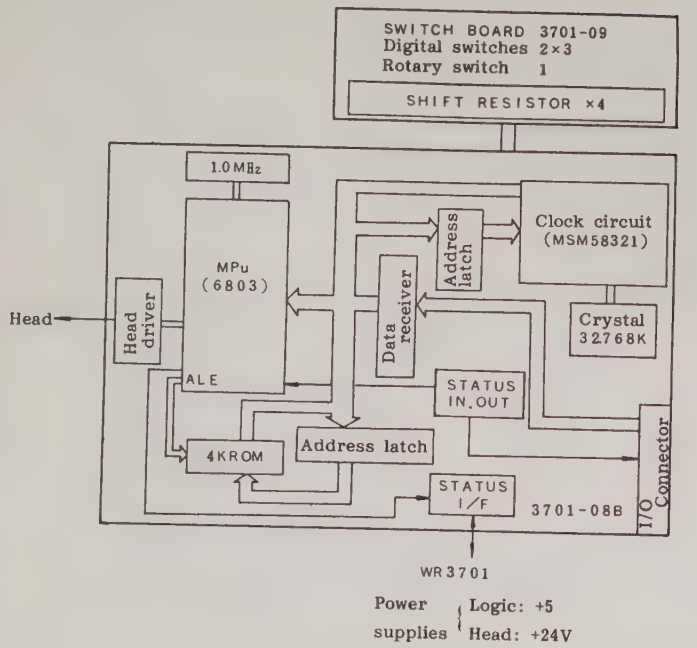
This driver provides the current flowing through the motor coil.

2.8.3 Connector Used to Make Connections to the Mainframe

Pin	Name	In/Out	Description
A1	GND		
B1	GND		
A2	PVMOT		≅ +20V Unfiltered voltage
B2	MVMOT		≅ -20V Unfiltered voltage
A3	+5V		+5V Regulator supply
B3			
A4			
B4	$\overline{EXT}$	OUT LEVEL	Low is output with the EXT switch OFF. High level is output with this switch ON.
A5	EVNT 1		Transistor which drives current on the on side is turned on when EVNT is ON.
B5	EVNT 2		Transistor which drives current on the baseline side is turned ON when EVNT is OFF.
A6			
B6	MRK C	OUT LEVEL	Marker writing voltage.
A7			
B7	HEAT OFF	OUT LEVEL	Recording not possible when high.
A8	PFEED	OUT PULSE	Pulse corresponding to 0.4mm movement. Used for printing at dot intervals.
B8	SET	OUT PULSE	When high, the digital switch month/day or time is set.
A9	$\overline{HEAT}$	OUT LEVEL	Heat is ON at low level.
B9	VCHRT	OUT LEVEL	Voltage corresponding to chart speed 0V at stopped condition and 0.3V at 100mm/s.
A10	$\overline{MICRO}$	OUT LEVEL	Low level at pen lift or when paper runs out.
B10	$\overline{PEN\ STP}$	OUT LEVEL	At low level output the pen motor input is 0V.

2.9 Printer Control Circuit

As shown in the figure below, this circuit consists of the board which is used to read the digital switch settings, and a clock circuit based on a 6803 microprocessor. These two boards, which include 4K bytes of ROM as well as other circuitry, are used to control the printer.



1 SWITCH BOARD

This switch board serially transfers the settings of the digital switches and rotary switch to the CPU. Signals transferred include DP, SP, SD, +5V, and GND (5 lines).

KP	Key Preset; reads the settings of the switches into a shift register.
SP	Shift pulse; shifts the contents of the shift register one at a time towards the SD pin.
SD	Serial Data

2 Clock Circuit

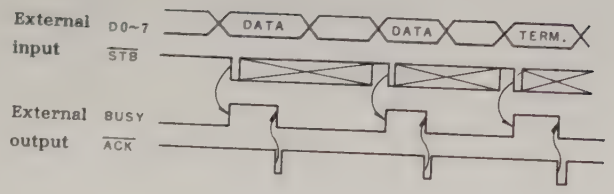
This clock circuit is based on a 32.678kHz oscillator and is used to control the clock month, day, and time.

3 Connections to the Mainframe

PFEED	Pulse used to establish the dot spacing. Corresponds to 0.4mm movement of the recording paper for each pulse.
SET	Sets the digital switch data into the real-time clock.
CHART OFF	Turns the head off when the recording paper stops. High level in the chart stopped condition.
EXT	High level in the EXT mode. Low level in other modes.
+24V	Print head drive supply
+5V	Logic supply
GND	0V

4 External Interface

Input signals are STB and D0 ∿ 7; output signals are BUSY, BUSY, and ACK. This interface conforms to the Centronix standard, with the input sequence as follows.



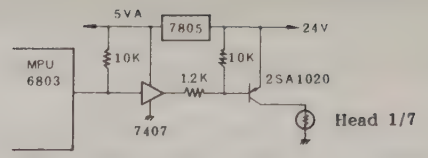
(Note)
ACK is a pulse of width 2μs (typical). Data should be held until the ACK output is completed. The terminator is LF or CR.

5 6803 Microprocessor

This microprocessor receives the signals between the units described in 1 and 4 above. It performs processing according to the contents of the 4K byte ROM.

6 Print Head Protection Circuit

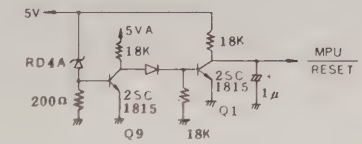
In order to protect the print head, this print head protective circuit controls the head drive supply and the logic supply input sequence and regulates +5V from the 24V supply.



Print head protection circuit

7 Microprocessor Reset Circuit

Transistor Q9 remains cut off until the 5V logic supply reaches above 4.6V, and when Q1 turns ON, the microprocessor is reset.



Precautions When Making External Connections

1 When making connections to an external device (CPU), verify the sequencing of the external interface (Centronix compatible), described in Section 4 .

2 Verify whether a CR or LF terminator is being sent after each character output.

3 Verify that unusable characters are not being sent (refer to the ASCII code table). Such characters will not result in printed output.

上位 / 下位	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0			(SP)	0	@	P						—	タ	ミ		
1			!	1	A	Q						ア	チ	ム		
2			"	2	B	R						イ	ツ	メ		
3			#	3	C	S						ウ	テ	モ		
4	Undefined		$	4	D	T						エ	ト	ヤ		
5		Undefined	%	5	E	U	Undefined	Undefined	Undefined	Undefined	Undefined	オ	ナ	ユ	Undefined	Undefined
6			&	6	F	V						カ	ニ	ヨ		
7			'	7	G	W						キ	ヌ	ラ		
8			(	8	H	X						ク	ネ	リ		
9			)	9	I	Y						ケ	ノ	ル		
10	(LF)		*	:	J	Z						コ	ハ	レ		
11	Undefined		+	;	K	[						サ	ヒ	ロ		
12			,	<	L	¥						シ	フ	ワ		
13	(CR)		-	=	M	]						ス	ヘ	ン		
14	Undefined		.	>	N	↑						セ	ホ	゛		
15			/	?	O	←						ソ	マ	゜		

Characters inside the bold-line boxes may be used.

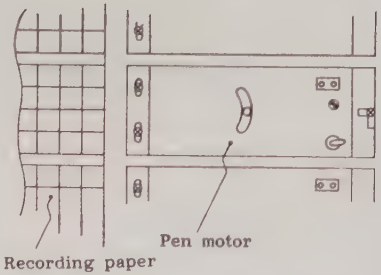
3. ADJUSTMENT

3.1 Pen Motor Mounting and Pen Perpendicularity Adjustment

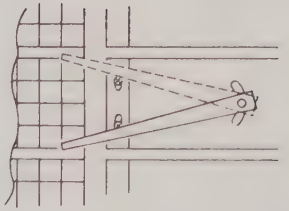
(1) Mount the pen motor using the three screws such that the recording paper baseline and pen motor side are parallel.

(2) Temporarily mount the pen to the pen motor shaft using the set screw.

(3) Move the pen to the left and right manually and observe the perpendicularity with the recording paper scale. If the line is not perpendicular, loosen the set screw and readjust the pen mounting position. Also verify the effective stroke at this time. The pen pressure for both S and W types is 20g ±3g.



(Pen motor mounting)



(Pen perpendicularity)

3.2 Stabilizer Adjustment (±15V ±0.4%)

(1) Remove the recorder rear plate.

(2) Adjust the ±15V using a flatblade screwdriver through the hole at the bottom of the rear plate.

(Notes)

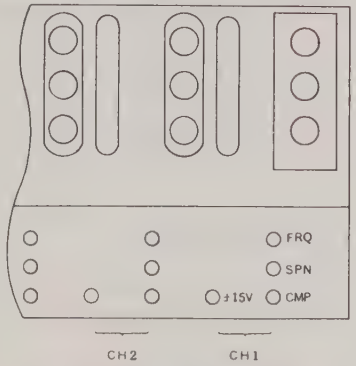
1. The circuit designation of the trimmer on the stabilizer printed circuit board is R6.

2. -15V is generated from +15V using an inverter. Adjust the +15V and verify that the -15V has been adjusted to within ±0.4% as well.

3. The ±15V may be measured at the preamplifier connector J8. This is done by removing the preamplifier for the channel to be adjusted.

   +15V: Pin B6 of J8
   -15V: Pin B5 of J8

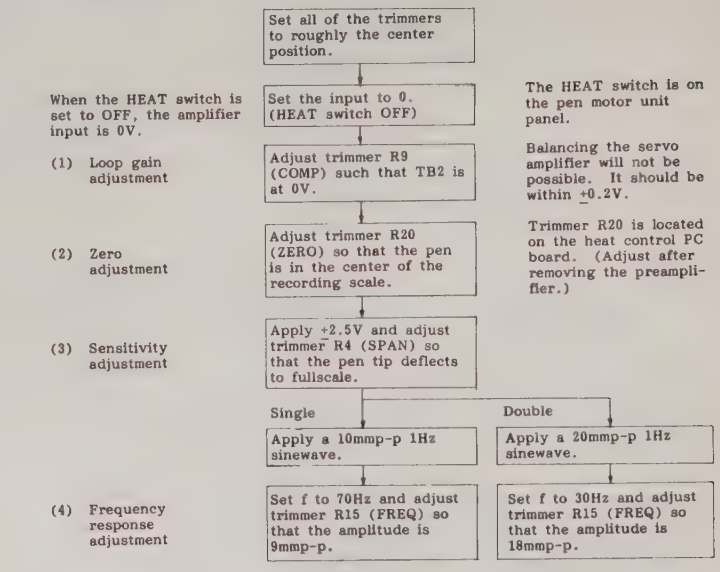
   These are measured with respect to the ⊖ pin (0V) of the input connector.

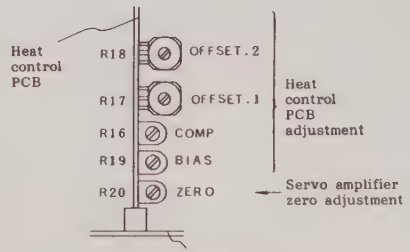


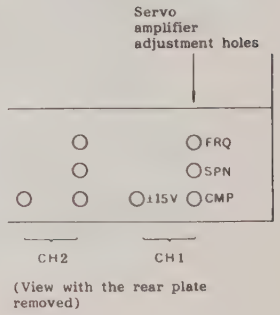
(View of the rear of the recorder with the rear plate removed)

3.3 Servo Amplifier Adjustment

There are four trimmers used to adjust the servo amplifier. One of these is used to adjust (i.e., zero) the bias voltage applied to the potentiometer, this trimmer being located on the heat control PC board of the pen motor unit.


Set all of the trimmers to roughly the center position.
Set the input to 0. (HEAT switch OFF)
When the HEAT switch is set to OFF, the amplifier input is 0V.
The HEAT switch is on the pen motor unit panel.
(1) Loop gain adjustment
Adjust trimmer R9 (COMP) such that TB2 is at 0V.
Balancing the servo amplifier will not be possible. It should be within ±0.2V.
(2) Zero adjustment
Adjust trimmer R20 (ZERO) so that the pen is in the center of the recording scale.
Trimmer R20 is located on the heat control PC board. (Adjust after removing the preamplifier.)
(3) Sensitivity adjustment
Apply +2.5V and adjust trimmer R4 (SPAN) so that the pen tip deflects to fullscale.
Single
Double
Apply a 10mmp-p 1Hz sinewave.
Apply a 20mmp-p 1Hz sinewave.
(4) Frequency response adjustment
Set f to 70Hz and adjust trimmer R15 (FREQ) so that the amplitude is 9mmp-p.
Set f to 30Hz and adjust trimmer R15 (FREQ) so that the amplitude is 18mmp-p.





(View with the rear plate removed)

3.4 Heat Control Circuit Adjustment (Same for S and W types)

- o All voltages are measured with respect to TB1 (GND)
- o When making adjustments, remove the thermal pen and replace with a 110Ω (2W) resistor.

(1) Offset Adjustment

- o Turn the HEAT switch (PMTR. switch) OFF.
- o The paper feed speed signal VCHRT is 0V (press the STOP switch).

OFFSET. 1 — Adjust trimmer R17 so that TB2 is 0V.

OFFSET. 2 — Adjust trimmer R18 so that TB3 is 0V.

(2) Gain adjustment / Bias adjustment

- o HEAT switch ON

COMP — With the pen deflected by a 1.25Hz 40mmp-p trianglewave, adjust trimmer R16 to approx. 250mV.

TB2 Waveform: +250mV / 0

Short TB4 and TB1 (GND).

V_0 voltage between positive terminal of 110Ω resistor and GND.

With the pen deflected by a 1.25Hz 40mmp-p trianglewave, adjust the heat control trimmer so that V0 is approx. 4.2V.

V0 Waveform: +4.2V / 0

Remove the shorting connection between TB4 and TB1. Stop the pen.

EXT. SW, HEAT. SW } ON Condition

BIAS — Adjust trimmer R19 such that V0 is approx. 3.8V.

V0 Waveform: +3.8V / 0

(3) Limiter check

Deflect the pen using an approx. 10Hz 40mmp-p trianglewave.

Feed less than 19mm/s: V0 = 8V
Feed less than 19mm/s: V0 = 13V

(4) Recording

Replace the thermal pen with a 110Ω resistance and try recording. Adjust the heat control trimmer.

3.5 Preamplifier Adjustment

(1) Balance adjustment

(There is no BAL. 2 trimmer on the L amplifier)

Set all trimmers to roughly the center position.

Set the input switch to OFF. Set the multiply to mV.

BAL. 1 — Adjust trimmer R12 (BAL. 1) so that the pen position in the minimum sensitivity is the same as the pen position with maximum sensitivity set.

Set the input switch to MEAS. (Input open)

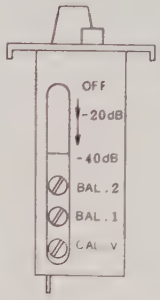
BAL. 2 — Adjust trimmer R6 (BAL. 2) so that the pen position in the MEAS is the same as that in the OFF position.

(2) Gain adjustment

Single	Double
Set the range to 500mV/cm and set the pen to the center position (baseline).	Set the range to 250mV/cm and set the pen to the center (baseline) position.
GAIN (Panel) — With 1V applied, adjust the gain control so that the deflection is 20mm.	With 1V applied, adjust the gain control so that the deflection is 40mm.

(3) Calibration voltage adjustment

Single	Double
With the pen set in the center (baseline) position, and the input switch to CAL. V, adjust trimmer R24 (CAL. V) so that the pen deflects 20mm.	With the pen set in the center (baseline) position, and the input switch to CAL. V, adjust trimmer R24 (CAL. V) so that the pen deflects 40mm.



(H Amplifier trimmer adjustment locations)

(Notes)

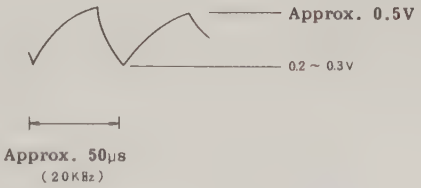
1. BAL. 1 is adjusted if the pen point moves (more than 0.3mm) when the range is changed.
2. BAL. 2 is adjusted if the pen tip moves (more than 0.3mm) when the multiply switching setting is changed.

3.6 Chart Driver (PR3701-13) Adjustment

- o Turn the pen motor HEAT switch off for all channels.
- o Remove the marker connector.
- o Remove the stepping motor connector J4.

(1) VR1: Adjust the voltage on pin B9 of connector J6 to 0V with the STOP switch ON.

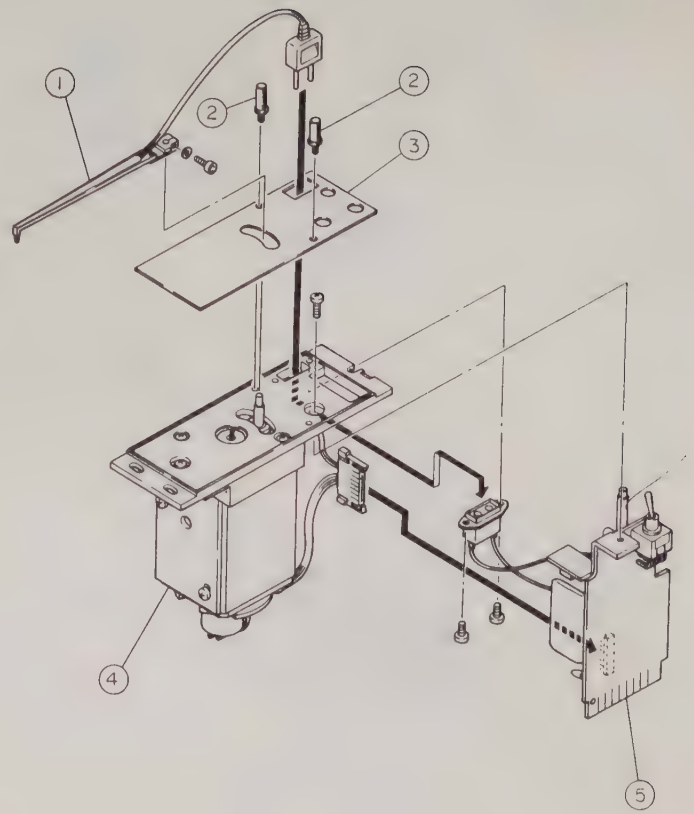
(2) VR2: Adjust the TP1 low level voltage to 0.2 ∿ 0.3V.



3.7 Event Marker Control (PR3701-13) Adjustment

With the feed speed at 10mm/s, adjust trimmer R12 so that the voltage on pin 6 of connector J3 is 8V. (Remove the connector for this adjustment.)

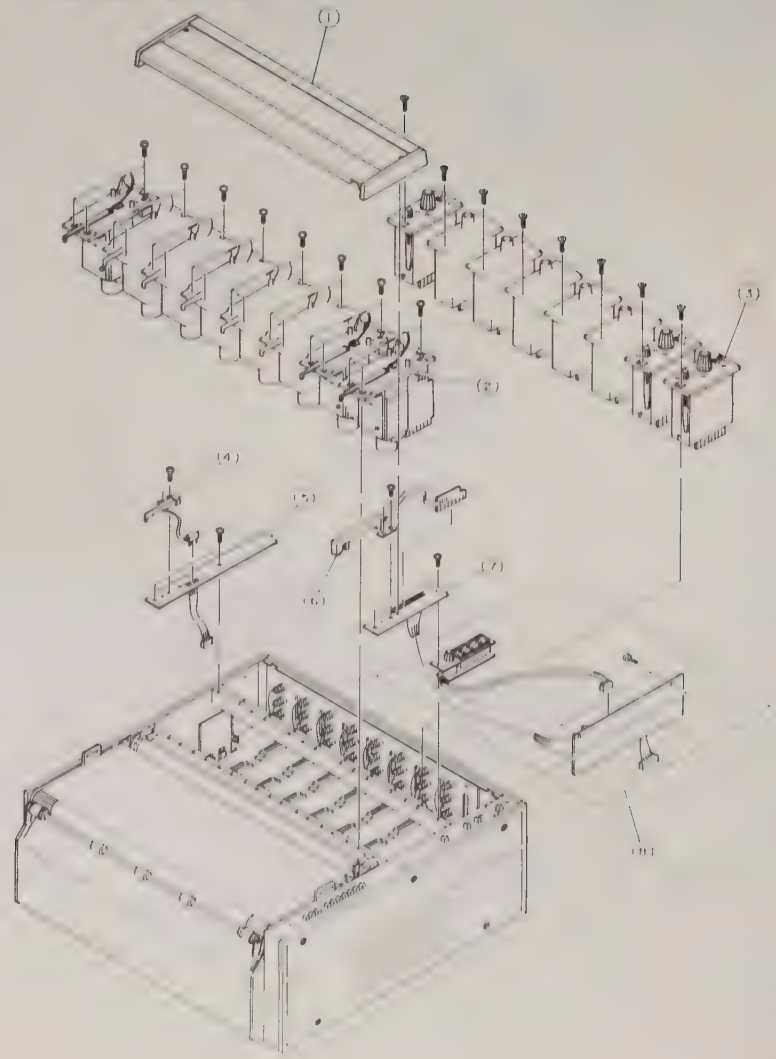
Pen Motor Mechanism



Pen Motor Mechanism

Item	Part & Block No.	Description		Remarks
1	772310114	Pen, KT-201		40 mm p-p
	772310124	Pen, KT-202		80 mm p-p
2	031013700	Knob		
3	037013020	Panel		40 mm p-p
	037013040	Panel		80 mm p-p
4	737013010	Pen Motor	GS3701	40 mm p-p
	737013030	Pen Motor	GW3701	80 mm p-p
5	772310113	Heat Control unit		40 mm p-p
	772310123	Heat Control unit		80 mm p-p

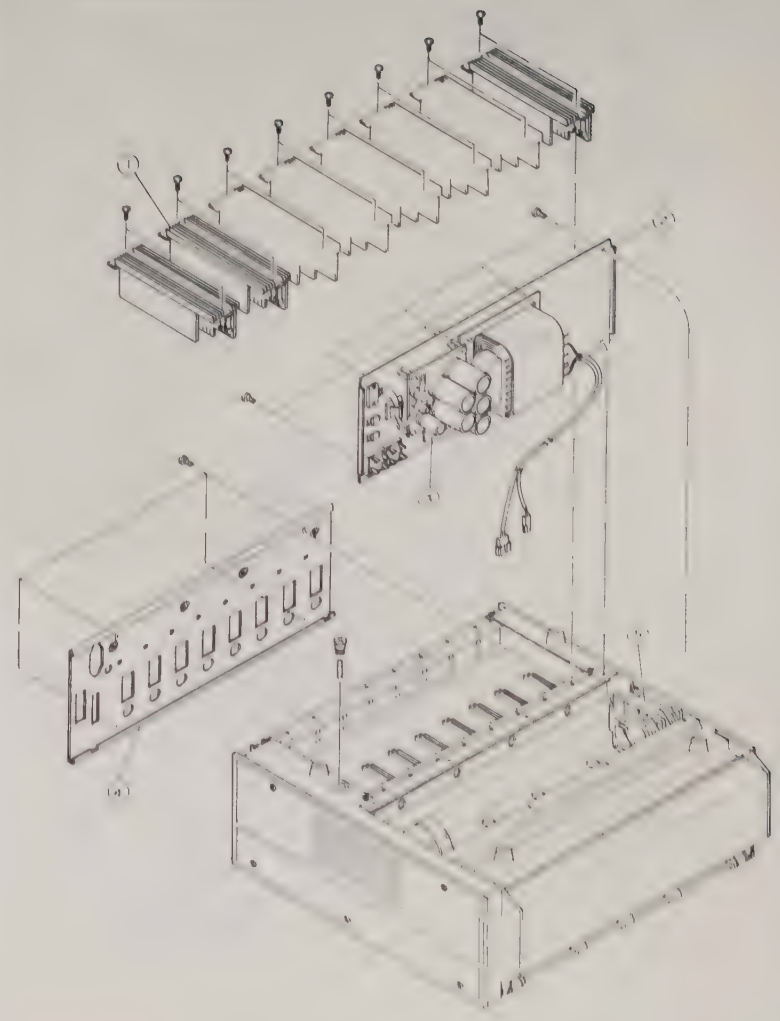
Pen Control & Pre Amp. Unit



Pen Control & Pre Amp. Unit

Item	Part & Block No.	Description	Remarks
1	037015241	Pen Cover	2 pen
	037015341	Pen Cover	4 pen
	037015441	Pen Cover	6 pen
	037015541	Pen Cover	8 pen
	037015641	Pen Cover	12 pen
2	737013010	Pen Motor	40 mm p-p
	737013030	Pen Motor	80 mm p-p
3	804310130	WA331	L Type
	804310140	WA332	H Type
	804310150	WA341	DL Type
	804310160	WA342	DH Type
4	731014320	KT-203	Pen Marker
5	037015210	Marker Panel	2~6 pen, 12 pen
	037015510	Marker Panel	8 pen
6	771310185	KT-208, Print Head	Thermal
7	037015010	Print Head Panel	
8		Print Control	

Bottom Side Assembly



Bottom Side Assembly

Item	Part & Block No	Description	Remarks
1		Main Amplifier	40 mm p-p
		Main Amplifier	80 mm p-p
2	037011510	Bottom Cover	2 pen
	037011540	Bottom Cover	4 pen
	037011561	Bottom Cover	6 pen
	037011580	Bottom Cover	8 pen
	037011600	Bottom Cover	12 pen
3	771370135	Power Circuit Block	2 pen
	771370145	"	4 pen
	771370155	"	6 pen
	771370165	"	8 pen
	771370175	"	12 pen
4	037015232	Back Cover	2 pen
	037015332	"	4 pen
	037015432	"	6 pen
	037015532	"	8 pen
	037015632	"	12 pen
5	509600004	Fan Motor	PXJ43B1

Chart Drive Mechanism & Control Unit

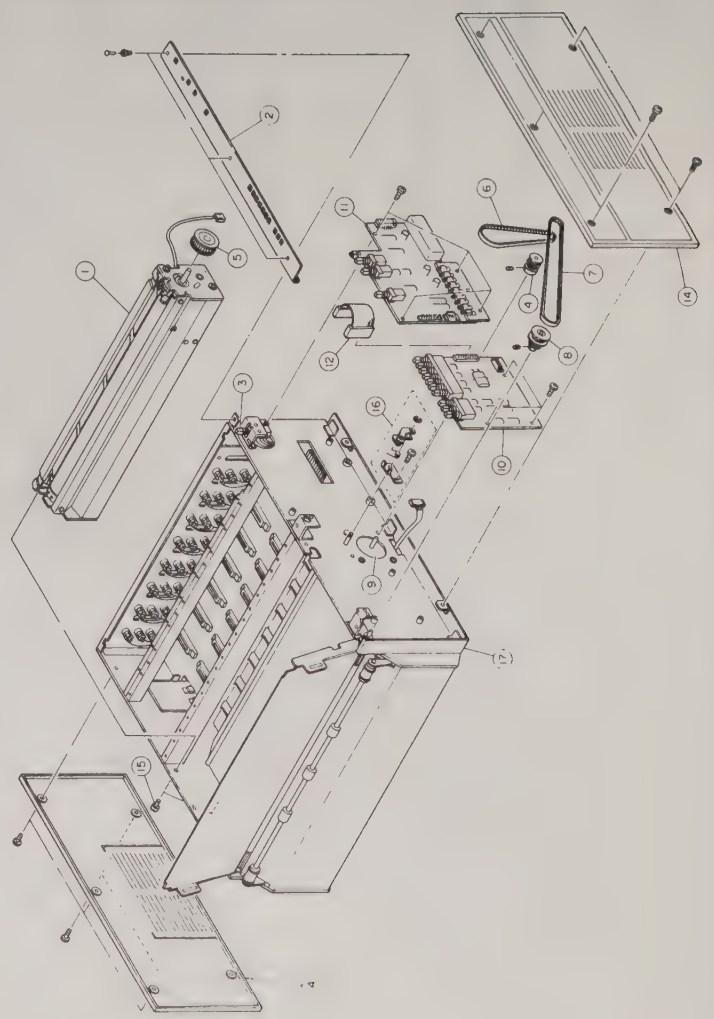
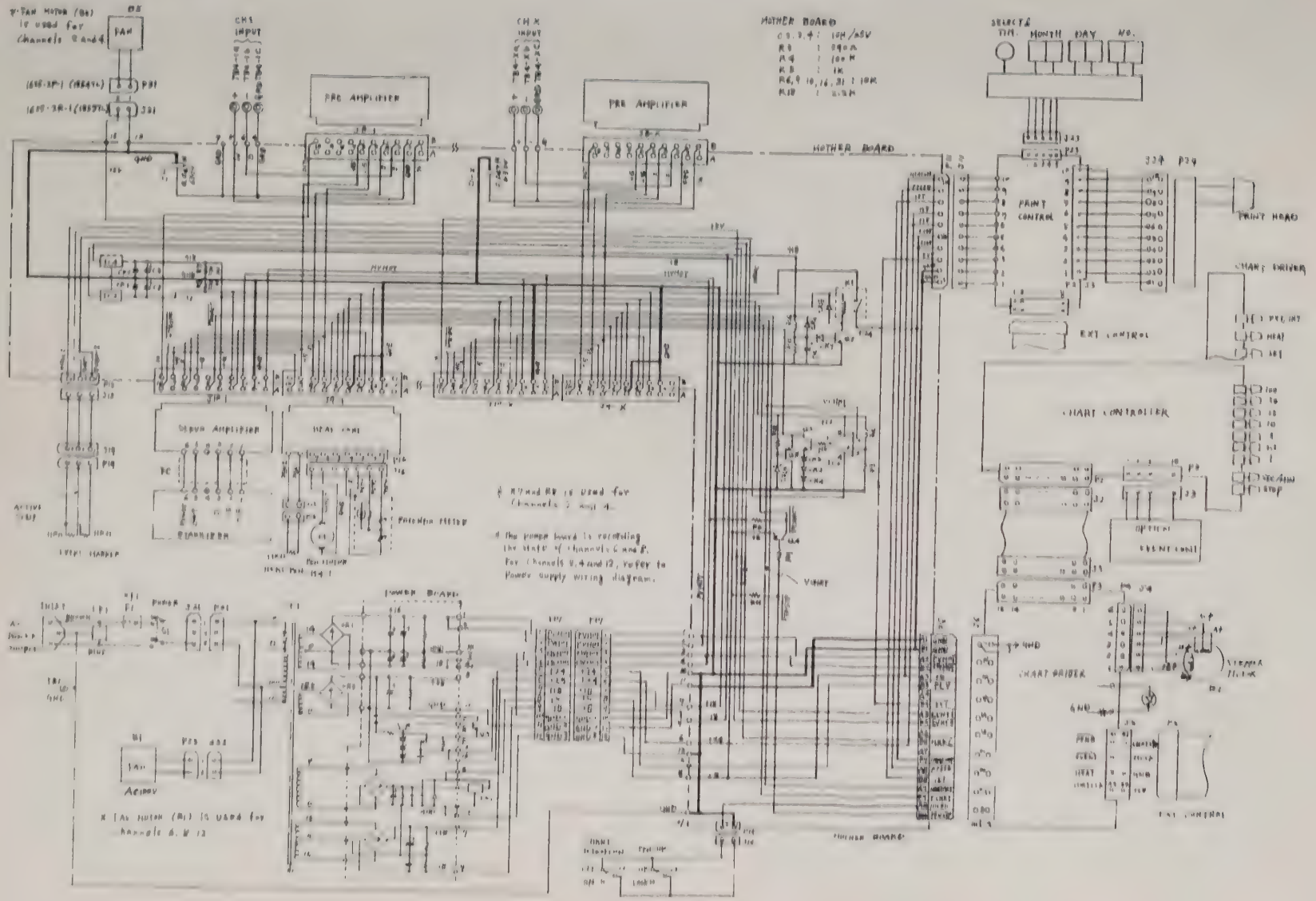


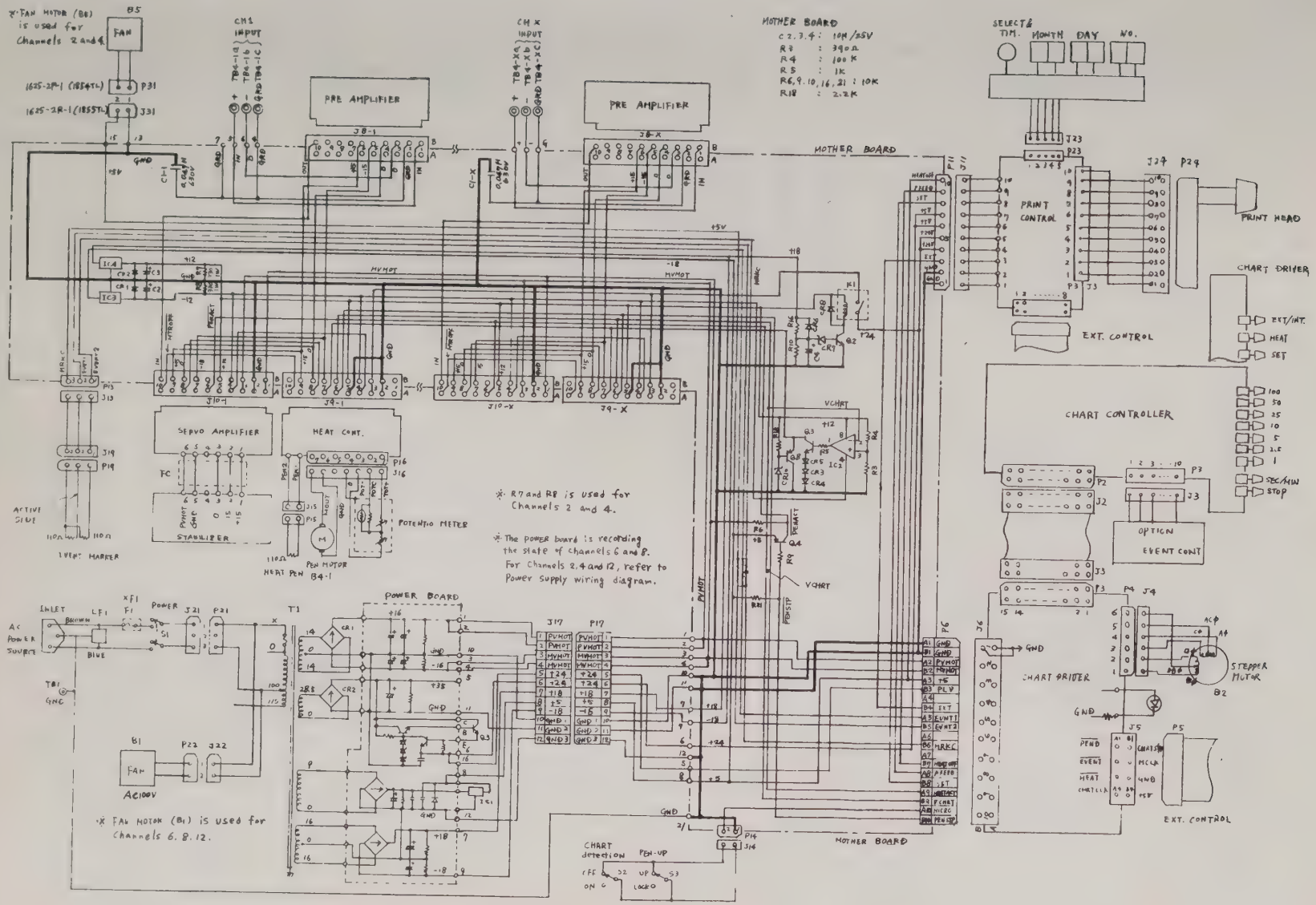
Chart Drive Mechanism & Control Unit

Item	Part & Block No.	Description	Remarks
1		Chart Drive Mechanism Block	2 pen
		"	4 pen
		"	6 pen
		"	8 pen
		"	12 pen
2	037015040	Control Panel	
3	508101010	Switch (Power)	1P-0008AC-1920
4	037016010	Pulley A	
5	037016020	Pulley B	
6	373701001	Belt	132MXL4.8
7	376621050	Belt	212MXL3.2
8	731014642	Slip Unit	
9		Stepping Motor	
10	771370115	Chart Control Unit	
11	771370116	Chart Drive Unit	
12		Flat Cable with Connector	
13	031012100	Screw, Chart Drive Block	
14	031015020	Side Cover	
15	031012100	Screw	
16		Belt Tensioner	
17	731010162	Front Panel	

Wiring Diagram & Mother Boart



Wiring Diagram & Mother Boart



Wiring Diagram & Mother Boart

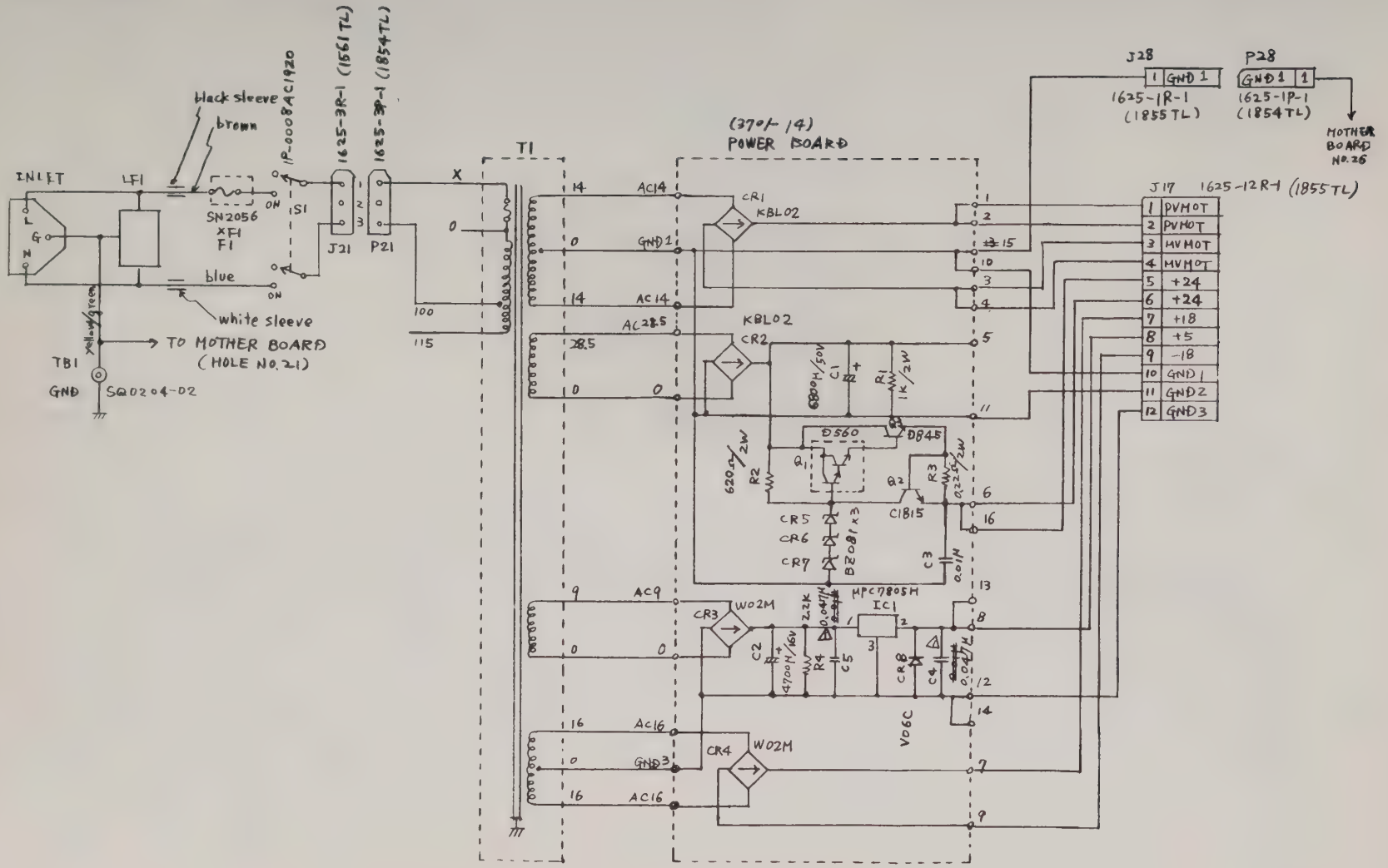
Figure	Part No.	Description		Type	Remarks
LF1	518110007	Line Filter		PZB4003-13	
W1	520110113	AC Cord		DP-8J-DEC130	
XF1	512400002	Fuse Holder		SN-2056	
INLET	513200107	AC Socket		NC174	
CAP	516100009	Cap		B101	For S1
TB1-a	514400010	Terminal	Red	W-R	x CH
TB1-b	514400010	Terminal	Red	W-R	x CH
TB1-c	514400011	Terminal	Black	W-B	x CH
TB4	514400004	Terminal		SQ0204-02	
F1	512300027	Fuse Time Lag		F102-S6A-4A	For 4, 6CH (AC100, 115V)
F1	512300028	"		F102-S6A-6A	For 8, 12CH (AC100, 115V)
B5	509600008	Fan motor	DC5V	FBP-04D05L	For 4CH (AC100, 115V)
B1	509600004	Fan Motor	AC100V	PXJ4381	For 6, 8, 12CH
P31	513200202	Connector, Plug		1625-2P-1	For 4CH
CNP	513400001	Contact Pin		1854TL	For P31
P22	513200202	Connector, Plug		1625-2P-1	For 6, 8, 12CH
CNP	513400001	Contact Pin		1854TL	For P22
S1	508101010	Switch Push		1P-0008AC1920	
S2	508401004	Switch Micro		CC-5-R	
S3	508401010	"		SS-5GL	
P5		Connector, Plug		FCN361J008-AG	
J21	513200302	Connector, Receptacle		CN-1625-3R-1	
CNP	513400022	Contact Pin		1561TL	
B2	509410015	Stepping Motor		PH55-D01-40	
J4	513400036	Connector, Receptacle		HNC2-2.5S-6	
J13	513400041	"		HNC2-2.5S-3	
J14	513400043	"	2P	HNC2-2.5S-2	
CNP	513400042	Contact Pin		HNC-2.5S-B	For J4, 13, 14
FC	520110119	Flat Cable	30 Pin	L106-30P	
F1	512300029	Fuse Time Lag	2A	F102-SGA-2A	For 4, 6CH (AC200, 220, 240V)
F1	512300031	Fuse Time Lag	3A	F102-SGA-3A	For 8, 12CH (AC200, 220, 240V)

Mother Board

Figure	Part No	Description	Type	Remarks
R3	501810239	R, Metal Film 390 1/4W ±1%	RN1/4-390F	
R4	501810510	R, " 100K 1/4W ±1%	RN1/4-100KF	
R5	G501810310	R, " 1K 1/4W ±1%	RN1/4-1KF	
R6	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R7	501105707	R, Carbon 330 1W ±5%	ERG1ANJ331	For 4CH
R8	"	R, " " " "	"	
R9	501810410	R, Metal Film 10K 1/4W ±1%	RN1/4-10KF	
R10	501810410	R, " " " "	"	
R16	501810410	R, Metal Film 10K 1/4W ±1%	RN1/4-10KF	
R18	501810322	R, " 2.2K 1/4W ±1%	RN1/4-2.2KF	
R21	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
C1 X	502601003	C, Oil 0.047μ 630WV	PMA-2J-473	x CH
C2	502103023	C, Electrolytic 10μ 25WV	SM25VB-10	
C3	"	C, " " "	"	
C4	"	C, " " "	"	
CR1	503100021	D_1, Si V_R = 200V I_F = 1.1A	V06C	
CR2	"	D_1, " " "	"	
CR3	503100020	D_1, " V_R = 30V I_F = 0.1A	IS953	
CR4	"	D_1, " " "	"	
CR5	"	D_1, " " "	"	
CR6	"	D_1, " " "	"	
CR7	503100001	D_1, Zener 6.1V 0.5W ±5%	WZ061	
CR8	503100020	D_1, Si V_R = 30V I_F = 0.1A	IS953	
CR10	503100052	D_1, Zener 3.2V 0.5W ±5%	WZ032	
IC2	503300054	IC, Op-Amp Dual	NJM4558D	
IC3	503300115	IC, Voltage Regulator	UPC7912H	
IC4	503300116	IC, "	UPC7812H	
Q2	503103014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
Q3	"	T, " " " "	"	"
Q4	503203016	T, PNP −30V −100mA 200mV	2SA1015, Y	2SA495
Q8	503200003	T, " −50V −1A 1W	2SA496, Y	
J8 X	513300604	Connector 10P x 2	225J21021-487	x CH
J9 X	"	" "	"	x CH
J10 X	"	" "	"	x CH
P11	513400040	" , Pin Holder 10P	HNC2-2 5P10DS	
P12	513400039	" " 3P	HNC2-2.5P3DS	
P13	"	" " 3P	"	
P14	513400038	" " 2P	HNC2-2 5P2DS	
P17	513201201	" , Plug 12P	1625-12P-1	
CNP	513400001	Contact Pin	1854TL	x 12, For P17

Figure	Part No.	Description	Type	Type	Remarks
K1	515110019	Relay	DC12V	HB1-DC12V	
PCB	511310151	Printed Circuit Board		3101-15C	For 4CH
PCB	511310191	"		3101-19B	For 6CH
PCB	511310011	"		3101-01D	For 8CH
BB1	514200309	Bus Bar	135mm, with Tube	T115-45-1351	For 4CH, 12CH
BB2	"	"	"	"	
BB3	514200310	"	"	T115-45-135	
BB1	514200313	Bus Bar	225mm, with Tube	T115-45-225I	For 6CH
BB2	"	"	"	"	
BB3	514200314	"	"	T115-45-225	
BB1	514200311	Bus Bar	315mm, with Tube	T115-45-315I	For 8CH, 12CH
BB2	"	"	"	"	
BB3	514200312	"	315mm	T115-45-315	
PCB	511310161	Printed Circuit Board		3101-16C	For 12CH
PCB	511310171	"		3101-17C	
P25	513200601	Connector, Plug	6P	1625-6P-1	For x 3 12CH
CNP	513400001	Contact Pin		1854TL	
J31	513200203	Connector Receptacle	2P	1625-2R-1	For 4CH
CNP	513400002	Contact Pin		1855TL	For J31

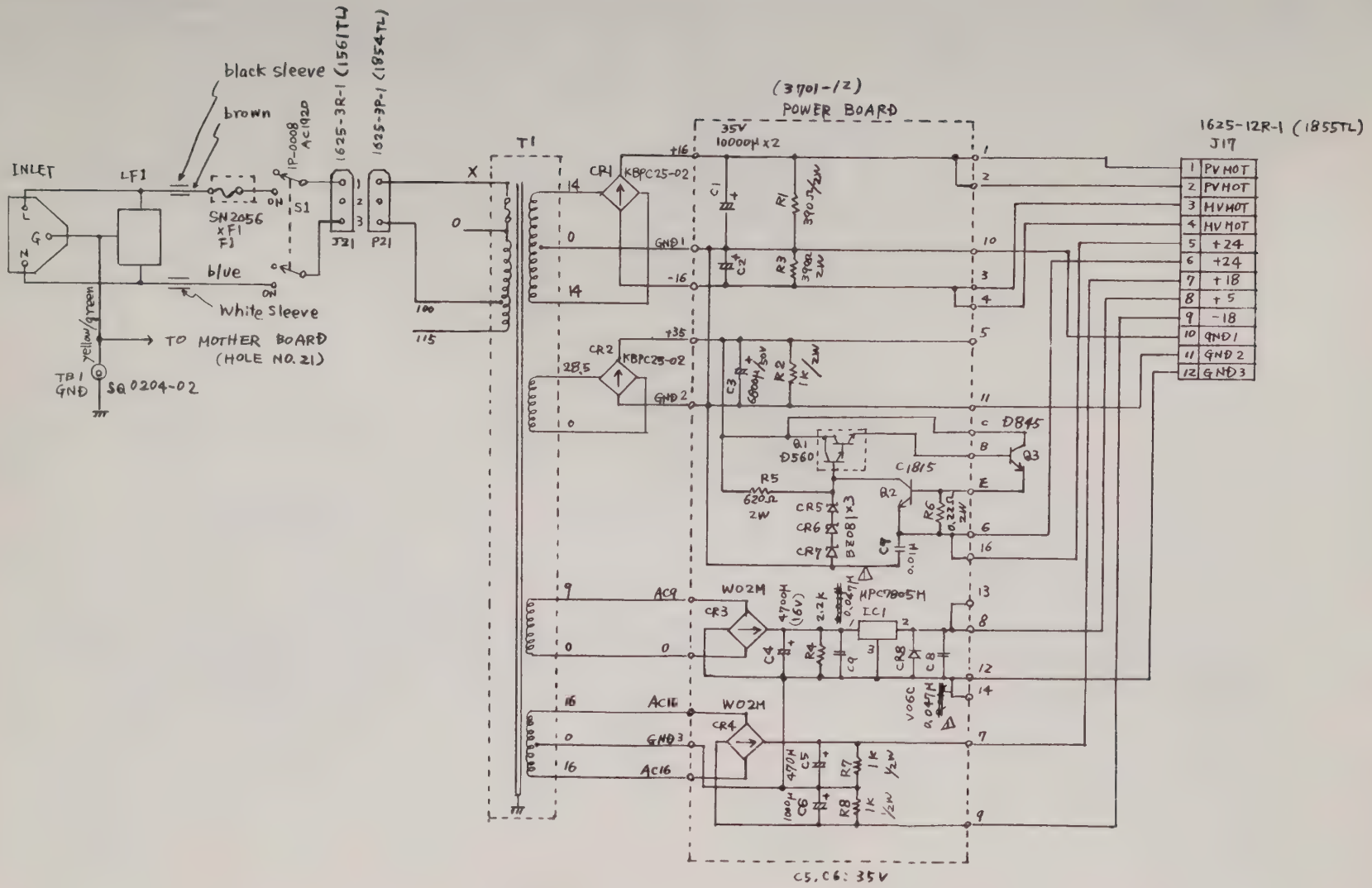
Power Unit (2CH)



Power Unit (2CH)

Figure	Part No.	Description	Type	Remarks
Q1	503200028	T, NPN 100V 5A 1.5W	2SD560, NEC	
Q2	503203014	T, " 30V 100mA 200mW	2SC1815, Y, ト	
Q3	503203050	T, " 150V 12A 120W	2SD845, O	
IC1	503300128	IC, Voltage Regulator 5V	UPC7805H	
CR1	503103010	Di, Diode Bridge	KBL02	
CR2	"	Di, "	"	
CR3	503100022	Di, Diode Bridge AC 140V 1.5A	W02M	
CR4	"	Di, " "	"	
CR5	503103031	Di, Zener 8.1V 1W ±5%	BZ081	
CR6	"	Di, " " " "	"	
CR7	"	Di, " " " "	"	
CR8	503100021	Di, Si V_R = 200V I_F = 1.1A	V06C	
R1	501606712	R, Metal Film 1K 2W ±5%	RSF2B-1KJ	
R2	501606720	R, " 620 2W ±5%	RSF2B-620J	
R3	501606721	R, Wirewound 0.22 2W ±5%	MU2-0.22J	
R4	501810322	R, Metal Film 2.2K 1/4W ±1%	RN1/4-2.2KF	
C1	502102021	C, Electrolytic 6800μ 50WV	ECET50R682SW	
C2	502102017	C, " 4700μ 16WV	ECEA1CS472	
C3	502303004	C, Myler Film 0.01μ 50WV	MFL-05S1	
C4	502303005	C, " 0.047μ "	MFL-05S47	
C5	502303005	C, " 0.047μ "	"	
PCB	511370140	Printed Circuit Board	3701-14	
P21	513200301	Connector, Receptacle	CN-1625-3P-1	
CNP	513400001	Contact Pin	1854 TL	For P21
J17	513201202	Connector, Receptacle	CN-1625-12R-1, ヰ	
J28	513200102	"	1625-1R-1	
CNP	513400002	Contact Pin	1855 TL	For J17
CNP	"	"	"	For J28
T1	510370110	Transformer	WR3701-1-2CH	AC100, 115V
T1	510370150	"	WR3701-2-2CH	AC200, 220, 240V
	520100012	Insulating Sheet	30B6001	For Q1, IC1
	520100013	" Washer	AC316A	For Q1, IC1

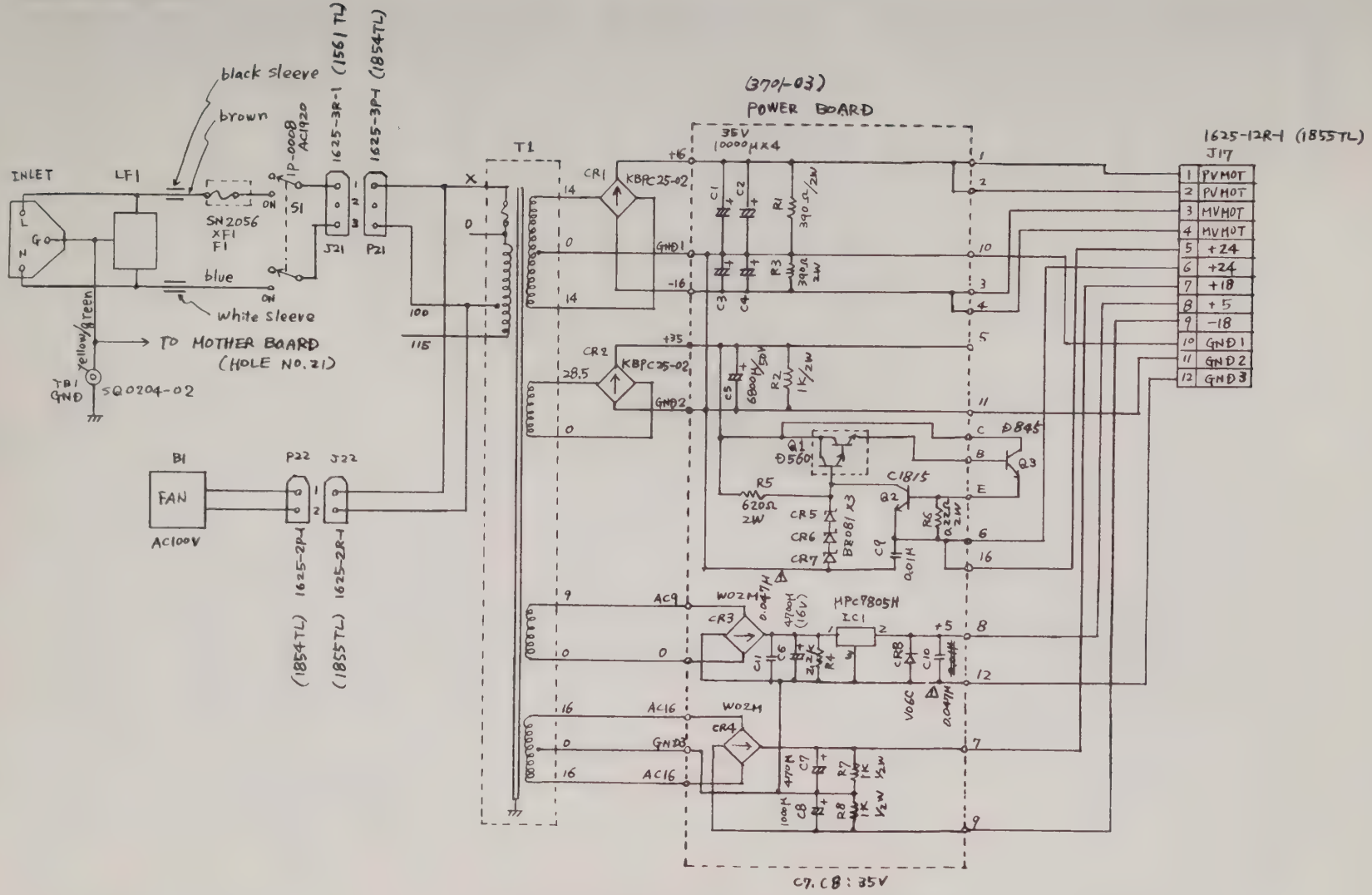
Power Unit (4CH)



Power Unit (4CH)

Figure	Part No.	Description				Type	Remarks
Q1	503200028	T, NPN	100V	5A	1.5W	2SD560, NEC	
Q2	503203014	T, "	30V	100mA	200mW	2SC1815, Y	
Q3	503203050	T, "	150V	12A	120W	2SD845, O	
IC1	503300128	IC, Voltage Regulator	5V			UPC7805H	
CR1	503103013	Di, Diode Bridge				KBPC25-02	
CR2	"	Di, "				"	
CR3	503100022	Di, Diode Bridge	AC140V	1.5A		W02M	
CR4	"	Di, "	"	"		"	
CR5	503103031	Di, Zener	8.1V	1W	±5%	BZ081	
CR6	"	Di, "	"	"	"	"	
CR7	"	Di, "	"	"	"	"	
CR8	503100021	Di, Si	V_R = 200V		I_F = 1.1A	V06C	
R1	501606711	R, Metal Film	390	2W	±5%	RSF2B-390J	
R2	501606712	R, "	1K	2W	±5%	RSF2B-1KJ	
R3	501606711	R, "	390	2W	±5%	RSF2B-390J	
R4	501810322	R, "	2.2K	1/4W	±1%	RN1/4-2.2KF	
R5	501606720	R, "	620	2W	±5%	RSF2B-620J	
R6	501606721	R, Wirewound	0.22	2W	±5%	MU2-0.22J	
R7	501204719	R, Solid	1K	1/2W	±5%	RC1/2-1KJ	
R8	"	R, "	"	"	"	"	
PCB	511370120	Printed Circuir Board				PR3701-12	
J17	513201202	Connector Receptacle				CN-1625-12R-1	
CNP	513400002	Contact Pin				1855TL	For J17
P21	513200301	Connector Receptacle				CN-1625-3P-1	
CNP	513400001	Contact Pin				1854TL	For P21
	520100012	Insulating Sheet				30B6001	For Q1, IC1
	520100013	Insulating Washer				AC316A	For Q1, IC1
C1	502102018	C, Electrolytic	10000μ		35WV	ECET35R103SW	
C2	"	C, "	"		"	"	
C3	502102021	C, "	6800μ		50WV	ECET50R682SW	
C4	502102017	C, "	4700μ		16WV	ECEA1CS472	
C5	502503013	C, "	470μ		35WV	35ULB470-M	
C6	502102019	C, "	1000μ		35WV	ECEA1VS102	
C7	502303004	C, Myler Film	0.01μ		50WV	MFL-05S1	
C8	502303005	C, "	0.047μ		"	MFL-05S47	
C9	502303005	C, "	0.047μ		"	MFL-05S47	
T1	510370120	Transformer				WR3701-1-4CH	AC100, 115V
T1	510370160	"				WR3701-2-4CH	AC200, 220, 240V

Power Unit (6CH, 8CH)



Power Unit (6CH, 8CH)

Figure	Part No.	Description				Type	Remarks
Q1	503200028	T, NPN	100V	5A	1.5W	2SD560, NEC	
Q2	503203014	T, "	30V	100mA	200mW	2SC1815, Y	
Q3	503203050	T, "	150V	12A	120W	2SD845, O	
IC1	503300128	IC, Voltage Regulator	5V			UPC7805H	
CR1	503103013	Di, Diode Bridge				KBPC25-02	
CR2	"	Di, "				"	
CR3	503100022	Di, Diode Bridge	AC140V		1.5A	W02M	
CR4	"	Di, "	"		"	"	
CR5	503103031	Di, Zener	8.1V	1W	±5%	BZ081	
CR6	"	Di, "	"	"	"	"	
CR7	"	Di, "	"	"	"	"	
CR8	503100021	Di, Si	V_R = 200V		I_F = 1.1A	V06C	
R1	501606711	R, Metal Film	390	2W	±5%	RSF2B-390J	
R2	501606712	R, "	1K	2W	±5%	RSF2B-1KJ	
R3	501606711	R, "	390	2W	±5%	RSF2B-390J	
R4	501810322	R, "	2.2K	1/4W	±1%	RN1/4-2.2KF	
R5	501606720	R, "	620	2W	±5%	RSF2B-620J	
R6	501606721	R, Wirewound	0.22	2W	±1%	MU2-0.22J	
R7	501204719	R, Solid	1K	1/2W	±5%	RC1/2-1KJ	
R8	"	R, "	"	"	"	"	
PCB	511370030	Printed Circuit Board				3701-03	
J17	513201202	Connnector, Receptacle				CN-1625-12R-1	
J22	513200203	"				1625-2R-1	
CNP	513400002	Contact Pin				1855TL	For J17, J22
P21	513200301	Connector, Receptacle				CN-1625-3P-1	
CNP	513400001	Contact Pin				1854TL	For P21
	520100012	Insulating Sheet				30B6001	For IC1, Q1
	520100013	Insulating Washer				AC316A	For IC1, Q1
T1	510370130	Transformer				WR3701-1-8CH	AC100, 115V
T1	510370170	"				WR3701-2-8CH	AC200, 220 240V
C1	502102018	C, Electrolytic	10000μ		35WV	ECET35R103SW	
C2	"	C, "	"		"	"	
C3	"	C, "	"		"	"	
C4	"	C, "	"		"	"	
C5	502102021	C, "	6800μ		50WV	ECET50R682SW	
C6	502102017	C, "	4700μ		16WV	ECEAICS472	

Figure	Part No.	Description			Type	Remarks
C7	502503013	C, Electrolytic	470μ	35WV	35ULB470-M	
C8	502102019	C, "	1000μ	35WV	ECEA1VS102	
C9	502303004	C, Myler Film	0.01μ	50WV	MFL-05S1	
C10	502303005	C, "	0.047μ	"	MFL-05S47	
C11	502303005	C, "	0.047μ	"	MFL-05S47	

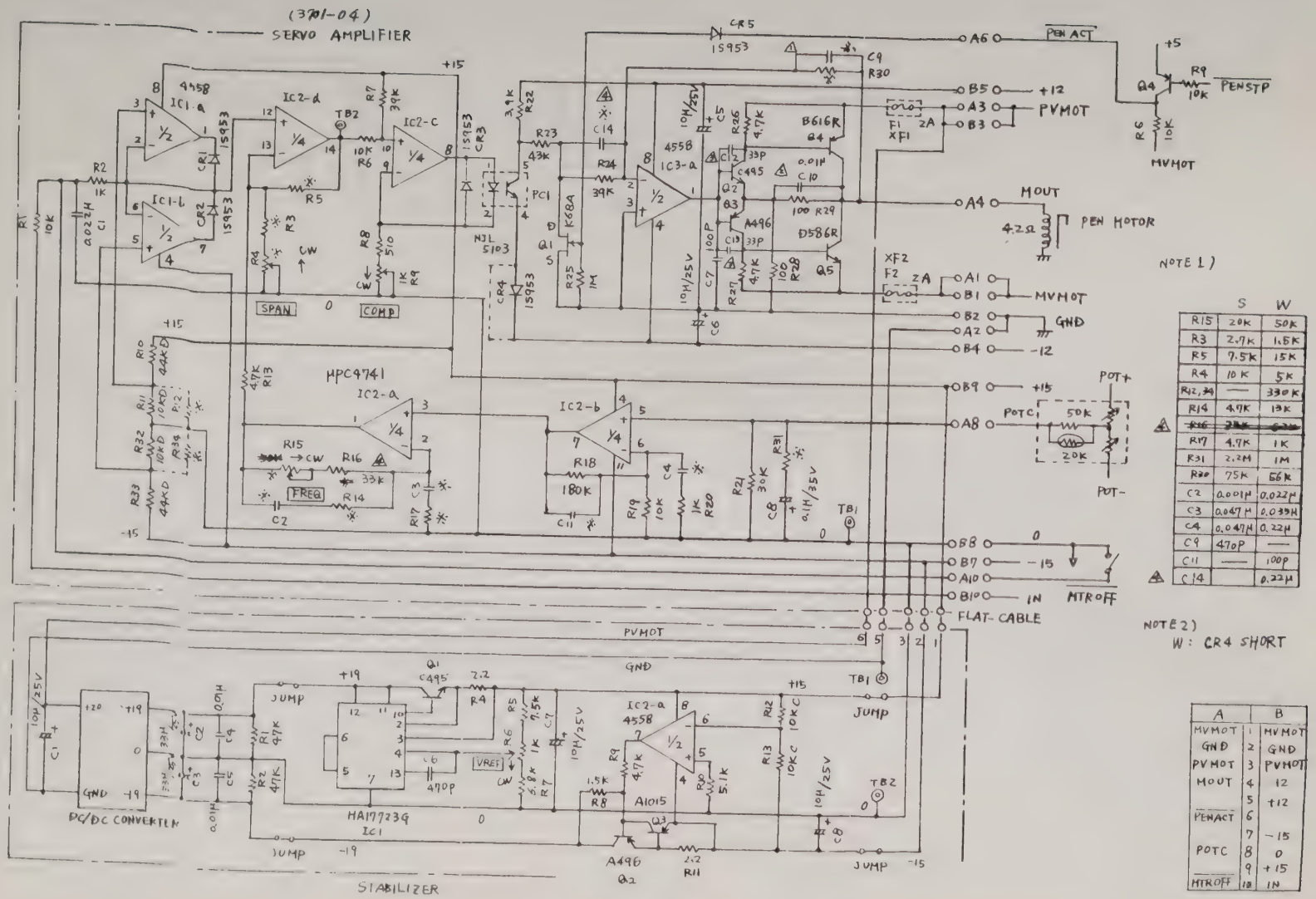
Power Unit (12CH)

Power Unit (12CH)

Figure	Part No.	Description				Type	Remarks
Q1	503200028	T, NPN	100V	5A	1.5W	2SD560, NEC	
Q3	503203050	T, NPN	150V	12A	120W	2SD845, O	
IC1	503300128	IC, Voltage Regulator	5V			UPC7805H	
CR1	503103013	Di, Diode Bridge				KBPC25-02	
CR2	〃	Di, 〃				〃	
CR3	〃	Di, 〃				〃	
J17	513201202	Connector, Receptacle				1625-12R-1	
J22	513200203	〃				1625-2R-1	
J25	513200302	〃				1625-3R-1	
	513400002	Contact Pin				1855TL	For J17, J22, J25
	513400002						
P21	513200301	Connector, Receptacle				1625-3P-1	
	513400001	Contact Pin				1854TL	For P21
T1	510370130	Transformer				WR3701-1-8CH	AC100, 115V
T1	510370170	〃				WR3701-2-8CH	AC200, 220, 240V
T2	510370140	Transformer				WR3701-1-4/12	AC100, 115V
T2		〃				WR3701-2-4/12	AC200, 220, 240V
R1	501606711	R, Metal Film	390	2W	±5%	RSF2B-390J	
R2	〃	R, 〃	〃	〃	〃	〃	
C1	502103047	C, Electrolytic	10000μ		35WV	ECEM1VR103X	
C2	〃	C, 〃	〃		〃	〃	
	520100012	Insulating Sheet				30B6001	For Q1, IC1
	520100013	Insulating Washer				AC316A	For Q1, IC1

Power Unit (12CH-Board)

Figure	Part No.	Description				Type	Remarks
Q2	503203014	T, NPN	30V	100mA	200mW	2SC1815, Y	
CR3	503100022	Di, Diode Bridge	AC140V		1.5A	W02M	
CR4	"	Di, "	"		"	"	
CR5	"	Di, Zener	8.1V	1W	±5%	BZ081	
CR6	"	Di, "	"	"	"	"	
CR7	"	Di, "	"	"	"	"	
CR8	503100021	Di, Si	V_R = 200V		I_F = 1.1A	V06C	
R1	501606711	R, Metal Film	390	2W	±5%	RSF2B-390J	
R2	501606712	R, "	1K	2W	±5%	RSF2B-1KJ	
R3	501606711	R, "	390	2W	±5%	RSF2B-390J	
R4	501810322	R, "	2.2K	1/4W	±1%	RN1/4-2.2KF	
R5	501606720	R, "	620	2W	±5%	RSF2B-620J	
R6	501606721	R, Wirewound	0.22	2W	±5%	MU2-0.22J	
R7	501204719	R, Solid	1K	1/2W	±5%	RC1/2-1KJ	
R8	"	R, "	"	"	"	"	
PCB	511370030	Printed Circuit Board				3701-03	
C1	502102018	C, Electrolytic	10000μ		35WV	ECET35R103SW	
C2	"	C, "	"		"	"	
C3	"	C, "	"		"	"	
C4	"	C, "	"		"	"	
C5	502102021	C, "	6800μ		50WV	ECET50R682SW	
C6	502102017	C, "	4700μ		16WV	ECEA1CS472	
C7	502503013	C, "	470μ		35WV	35ULB470-M	
C8	502102019	C, "	1000μ		35WV	ECEA1VS102	
C9	502303004	C, Myler Film	0.01μ		50WV	MFL-05S1	
C10	502303005	C, "	0.047μ		"	MFL-05S47	
C11	"	C, "	"		"	"	



	S	W
R15	20K	50K
R3	2.7K	1.5K
R5	7.5K	15K
R4	10K	5K
R12,34	—	330K
R14	4.7K	13K
~~R16~~	~~33K~~	~~6.2K~~
R17	4.7K	1K
R31	2.2M	1M
R20	75K	56K
C2	0.001μ	0.022μ
C3	0.047μ	0.033μ
C4	0.047μ	0.22μ
C9	470P	—
C11	—	100P
C14		0.22μ

A		B
MVMOT	1	MVMOT
GND	2	GND
PVMOT	3	PVMOT
MOUT	4	12
	5	+12
PENACT	6	
	7	-15
POTC	8	0
	9	+15
MTROFF	10	IN

Servo Amplifier (S)

Figure	Part No.	Description				Type	Remarks
R1	501810410	R, Metal Film	10K	1/4W	±1%	RN1/4-10KF	
R2	501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R3	501810327	R, "	2.7K	1/4W	±1%	RN1/4-2.7KF	
R4	504207021	R, Trimmer Cermet	10K			TM10KPH-10K	
R5	501810375	R, Metal Film	7.5K	1/4W	±1%	RN1/4-7.5KF	
R6	501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
R7	501810439	R, "	39K	1/4W	±1%	RN1/4-39KF	
R8	501810251	R, "	510	1/4W	±1%	RN1/4-510F	
R9	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R10	501303444	R, Metal Film	44K	1/4W	±0.5%	RNE1/4-44KD	
R11	501303408	R, "	10K	1/4W	±0.5%	RNE1/4-10KD	
R13	501810347	R, Metal Film	4.7K	1/4W	±1%	RN1/4-4.7KF	
R14	501810347	R, "	"	"	"	RN1/4-4.7KF	
R15	504207031	R, Trimmer Cermet	20K			TM10KPH-20K	
R16	501810433	R, Metal Film	33K	1/4W	±1%	RN1/4-33KF	
R17	501810347	R, "	4.7K	1/4W	±1%	RN1/4-4.7KF	
R18	501810518	R, "	180K	1/4W	±1%	RN1/4-180KF	
R19	501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
R20	501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R21	501810430	R, "	30K	1/4W	±1%	RN1/4-30KF	
R22	501810339	R, "	3.9K	1/4W	±1%	RN1/4-3.9KF	
R23	501810443	R, "	43K	1/4W	±1%	RN1/4-43KF	
R24	501810439	R, "	39K	1/4W	±1%	RN1/4-39KF	
R25	501810610	R, "	1M	1/4W	±1%	RN1/4-1MF	
R26	501810347	R, "	4.7K	1/4W	±1%	RN1/4-4.7KF	
R27	501810347	R, "	"	"	"	RN1/4-4.7KF	
R28	501810210	R, "	100	1/4W	±1%	RN1/4-100F	
R29	501810210	R, "	"	"	"	RN1/4-100F	
R30	501810475	R, "	75K	1/4W	±1%	RN1/4-75KF	
R31	501203740	R, Solid	2.2M	1/4W	±5%	RC1/4-2.2MJ	
R32	501303408	R, Metal Film	10K	1/4W	±0.5%	RNE1/4-10KD	
R33	501303444	R, "	44K	1/4W	±0.5%	RNE1/4-44KD	
C1	502303008	C, Myler Film	0.022μ		50WV	MFL-05S22	
C2	502303002	C, "	0.001μ		50WV	MFL-05DI	
C3	502303005	C, "	0.047μ		50WV	MFL-05S47	
C4	502303005	C, "	0.047μ		50WV	MFL-05S47	
C5	502103023	C, Electrolytic	10μ		25WV	SM25VB-10	
C6	502103023	C, "	"		"	SM25VB-10	
C7	502403009	C, Ceramic	100P		50WV	VFD04-101K-K2J	
C8	502203012	C, Tantalum	0.1μ		35WV	CS15EIV0R1M	
C9	502403003	C, Ceramic	470P		50WV	USD04-SL-471K	
C10	502303004	C, Myler Film	0.01μ		50WV	MFL-05SI	
C12	502403034	C, Ceramic	33P		50WV	RAU04SL330KL05AE	

Figure	Part No.	Description				Type	Remarks
C13	5024030J4	C, Ceramic	33P		50WV	RAU04SL330KL05AE	
CR1	5031000J0	Di, Si	V_R = 30V		I_F = 0.1A	IS953	
CR2	5031000J0	Di, "	"		"	IS953	
CR3	5031000J0	Di, "	"		"	IS953	
CR4	5031000J0	Di, "	"		"	IS953	
CR5	5031000J0	Di, "	"		"	IS953	
IC1	5033000J4	IC, Op Amp	Dual			NJM4558D	
IC2	5033000J4	IC, "	Quad			UPC4741C	
IC3	5033000J4	IC, "	Dual			NJM4558D	
PCB	5113700J0	Printed Circuit Board				370104	
Q1	5032600J5	T, N-J FET				2SK68A	
Q2	5032000J1	T, NPN	50V	1A	1W	2SC496, O	
Q3	5032000J3	T, PNP	50V	1A	1W	2SA496, Y	
Q4	5032000J8	T, PNP	80V	5A	60W	2SB616, B	
Q5	5032000J1	T, NPN	80V	5A	60W	2SD586, B	
TB1	5134000J7	Test terminal				TC-1G	
TB2	5134000J7	"				TC-1G	
PC1	5034000J8	Photo Coupler	I_F = 70mA			NJL5103D	
			I_C = 100mA, 60% ≤ CTR ≤ 150%				
F1	5123000J1	Fuse	2A			7142.2A	
F2	5123000J1	"	"			7142.2A	
FX1	5124000J8	Fuse Holder				OG751-0056	
FX2	5124000J8	"				OG751-0056	
FX3	5124000J8	"				OG751-0056	
FX4	5124000J8	"				OG751-0056	
FC	5201100J3	Flat Cable	6P			6-1353P2S4	

Servo Amplifier (W)

Figure	Part No.	Description				Type	Remarks
R1	5018104J0	R, Metal Film	10K	1/4W	±1%	RN1/4 10KF	
R2	5018103J0	R, "	1K	1/4W	±1%	RN1/4 1KF	
R3	5018103J5	R, "	1.5K	1/4W	±1%	RN1/4 1.5KF	
R4	5042070J8	R, Trimmer Cermet	5K			TM10KPH5K	
R5	5018104J5	R, Metal Film	15K	1/4W	±1%	RN1/4 15KF	
R6	5018104J0	R, "	10K	1/4W	±1%	RN1/4 10KF	
R7	5018104J9	R, "	39K	1/4W	±1%	RN1/4 39KF	
R8	5018102J1	R, "	510	1/4W	±1%	RN1/4 510F	
R9	5042070J9	R, Trimmer Cermet	1K			TM10KPH1K	
R10	5013034J4	R, Metal Film	44K	1/4W	±0.5%	RNE1/4 44KD	
R11	5013034J8	R, "	10K	1/4W	±0.5%	RNE1/4 10KD	
R12	5018105J3	R, "	330K	1/4W	±1%	RN1/4 330KF	
R13	5018103J7	R, "	4.7K	1/4W	±1%	RN1/4 4.7KF	
R14	5018104J3	R, "	13K	1/4W	±1%	RN1/4 13KF	
R15	5042070J1	R, Trimmer Cermet	50K			TM10KPH50K	
R16	5018104J2	R, Metal Film	62K	1/4W	±1%	RN1/4 62KF	
R17	5018103J0	R, "	1K	1/4W	±1%	RN1/4 1KF	
R18	5018105J8	R, "	180K	1/4W	±1%	RN1/4 180KF	
R19	5018104J0	R, "	10K	1/4W	±1%	RN1/4 10KF	
R20	5018103J0	R, "	1K	1/4W	±1%	RN1/4 1KF	
R21	5018104J8	R, "	30K	1/4W	±1%	RN1/4 30KF	
R22	5018103J9	R, "	3.9K	1/4W	±1%	RN1/4 3.9KF	
R23	5018104J1	R, "	4.3K	1/4W	±1%	RN1/4 4.3KF	
R24	5018104J9	R, "	39K	1/4W	±1%	RN1/4 39KF	
R25	5018106J0	R, "	1M	1/4W	±1%	RN1/4 1MF	
R26	5018103J7	R, "	4.7K	1/4W	±1%	RN1/4 4.7KF	
R27	5018103J7	R, "	"	"	"	RN1/4 4.7KF	
R28	5018102J0	R, "	100	1/4W	±1%	RN1/4 100F	
R29	5018102J0	R, "	"		"	RN1/4 100F	
R30	5018104J6	R, "	56K	1/4W	±1%	RN1/4 56KF	
R31	5018106J0	R, "	1M	1/4W	±1%	RN1/4 1MF	
R32	5013034J8	R, "	10K	1/4W	±0.5%	RNE1/4 10KD	
R33	5013034J4	R, "	44K	1/4W	±0.5%	RNE1/4 44KD	
R34	5018105J3	R, "	330K	1/4W	±1%	RN1/4 330KF	
C1	5024030J8	C, Mylar Film	0.022μ		50WV	MEL 0522	
C2	5024030J8	C, "	0.022μ		50WV	MEL 0522	
C3	5024030J9	C, "	0.033μ		50WV	MEL 0533	
C4	5025040J5	C, "	0.22μ		100WV	EMEO 22 100	
C5	5021003J1	C, Electrolytic	10μ		25WV	SM25VB10	
C6	5021003J1	C, "	"		"	SM25VB10	
C7	5024030J9	C, Ceramic	100P		50WV	UCD4-101K-K21	
C8	5022003J2	C, Tantalum	0.1μ		35WV	CSL35V0E1M	
C10	5024030J4	C, Mylar Film	0.01μ		50WV	MEL 0510	
C11	5024030J9	C, Ceramic	100P		50WV	UCD4-101K-K21	

Figure	Part No	Description			Type	Remarks
C12	502403034	C, Ceramic	33P	50WV	RAU04SL330KL05AE	
C13	502403034	C, "	"	"	RAU04SL330KL05AE	
C14	502503005	C, Myler Film	0.22μ	100WV	EML0.22-100	
CR1	503100020	D_1, Si	V_R = 30V	I_F = 0.1A	IS953	
CR2	503100020	D_1, "	"	"	IS953	
CR3	503100020	D_1, "	"	"	IS953	
CR4	503100020	D_1, "	"	"	IS953	
CR5	503100020	D_1, "	"	"	IS953	
IC1	503300054	IC, Op-Amp	Dual		NJM4558D	
IC2	503300034	IC, "	Quad		UPC4741C	
IC3	503300054	IC, "	Dual		NJM4558D	
PCB	511370040	Printed Circuit Board			3701-04	
Q1	503203015	T, N-J-FET			2SK68A	
Q2	503200011	T, NPN	50V	1A 1W	2SC495, O	
Q3	503200003	T, PNP	−50V	−1A 1W	2SA496, Y	
Q4	503200018	T, PNP	−80V	−5A 60W	2SB616, R	
Q5	503200021	T, NPN	80V	5A 60W	2SD586, R	
TB1	513400027	Test Terminal			LC-1-G	
TB2	513400027	"			LC-1-G	
PC1	503300108	Photo Coupler	I_F = 70mA IC = 100mA, 60% ≤ CTR ≤ 150%		NJL5103D	
F1	512300011	Fuse	2A		7142-2A	
F2	512300011	"	"		7142-2A	
FX1	512400008	Fuse Holder			OG751-0056	
FX2	512400008	"			OG751-0056	
FX3	512400008	"			OG751-0056	
FX4	512400008	"			OG751-0056	
FC	520110061	Flat Cable	6P		6-1-35-3P25A	

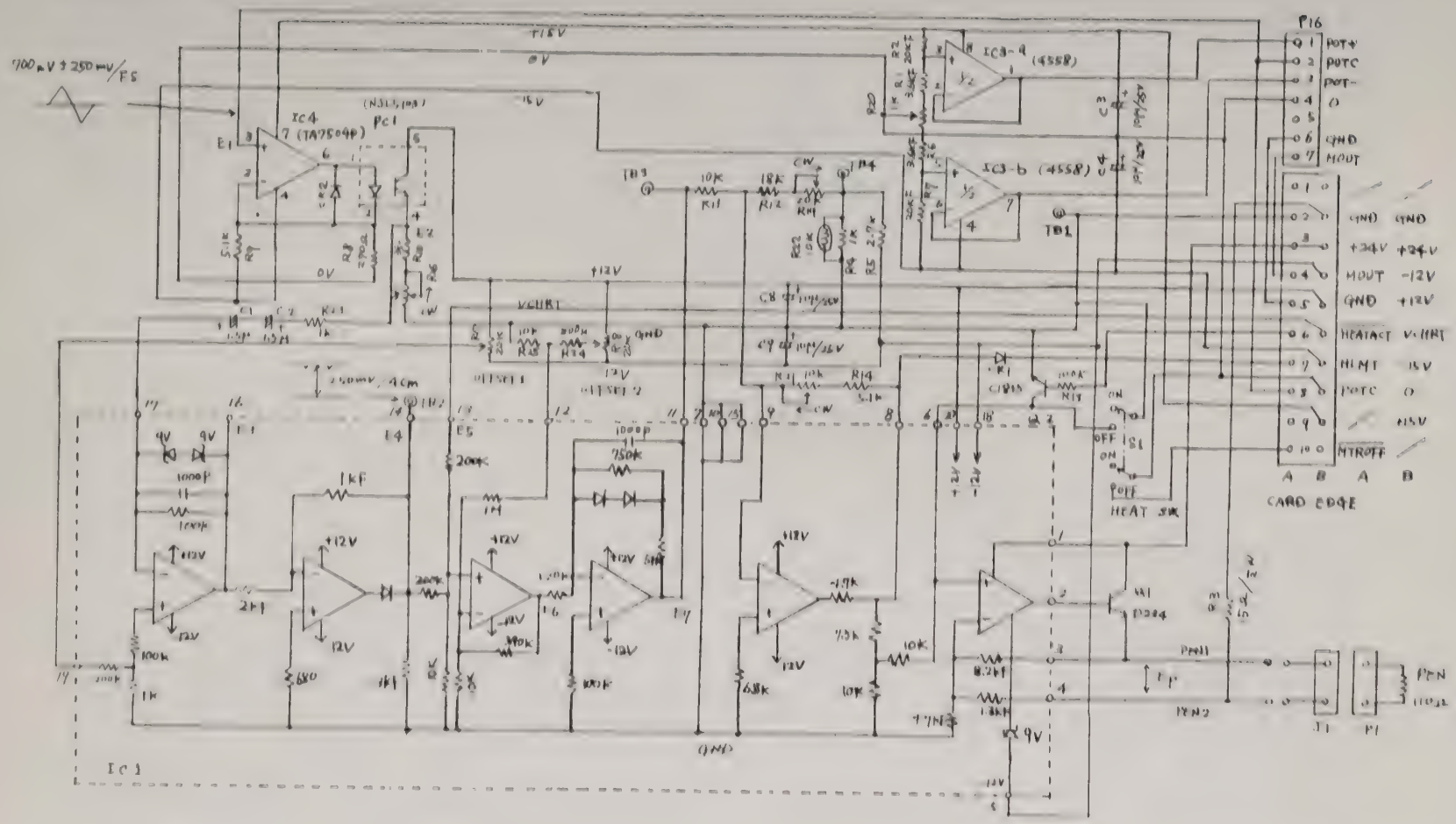
Stabilizer

Figure	Part No	Description				Type	Remarks
R1	501810447	R, Metal Film	47K	1/4W	±1%	RN1/4-47KF	
R2	501810447	R, "	"	"	"	RN1/4-47KF	
R4	501203701	R, Solid	2.2	1/4W	±5%	RC1/4-2.2ΩJ	
R5	501810375	R, Metal Film	7.5K	1/4W	±1%	RN1/4-7.5KF	
R6	504207022	R, Trimmer Cermet	2K			TM10KPH-2K	
R7	501810368	R, Metal Film	6.8K	1/4W	±1%	RN1/4-6.8KF	
R8	501810315	R, "	1.5K	1/4W	±1%	RN1/4-1.5KF	
R9	501810347	R, "	4.7K	1/4W	±1%	RN1/4-4.7KF	
R10	501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R11	501203701	R, Solid	2.2	1/4W	±5%	RC1/4-2.2ΩJ	
R12	501303307	R, Metal Film	10K	1/4W	±1%	RNE1/4-10KC	
R13	501303307	R, "	"	"	"	RNE1/4-10KC	
C1	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C2	502103011	C, "	33μ	25WV		SL25VB-33	
C3	502103011	C, "	"	"		SL25VB-33	
C4	502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C5	502403007	C, "	"	"		ULD06-103-L2A	
C6	502403003	C, "	470P	50WV		USD04-SL-471K	
C7	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C8	502103023	C, "	"	"		SM25VB-10	
IC1	503300117	IC, Voltage Regulator				HA17723G,	
IC2	503300054	IC, Op-Amp	Dual			NJM4558D	
Q1	503200011	T, NPN	50V	1A	1W	2SC495, O	
Q2	503200003	T, PNP	−50V	−1A	1W	2SA496, Y	
Q3	503203016	T, PNP	−30V	−100mA	200mW	2SA1015, Y	2SA495
PCB	511311150	Printed Circuit Board				3111-05	
TB1	513400027	Test Terminal				LC-1-G	
TB2	513400027	"				LC-1-G	
	518100004	DC/DC Converter				CE-0134	

Figure	Part No	Description				Type	Remarks
R1	501810336	R, Metal Film	3.6K	1/4W	±1%	RN1/4-3.6KF	
R2	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R3	G501304701	R, "	15	1/2W	±5%	RNE1/2-15J	
R4	G501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R5	G501810327	R, "	2.7K	1/4W	±1%	RN1/4-2.7KF	
R6	G501810336	R, "	3.6K	1/4W	±1%	RN1/4-3.6KF	
R7	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R8	501810227	R, "	270	1/4W	±1%	RN1/4-270F	
R9	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R11	G501810410	R, Metal Film	10K	1/4W	±1%	RN1/4-10KF	
R12	G501810418	R, "	18K	1/4W	±1%	RN1/4-18KF	
R13	G501810510	R, "	100K	1/4W	±1%	RN1/4-100KF	
R14	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R15	501810433	R, "	33K	1/4W	±1%	RN1/4-33KF	
R17	G504207031	R, Metal Film	20K			TM10KPH-20K	
R18	G504207031	R, "	20K			TM10KPH-20K	
R19	A505103023	R, Trimmer Cermet	20K			RJ6X-20K	
R20	G505103011	R, "	1K			RJ6X-1K	
R21	504103021	R, Variable Carbon	10K			RV16YP20SB10K	
R22	B503400005	R, Thermister	10K			10KD7-15%	
R23	501810310	R, Metal Film	1K	1/4W	±1%	RN1/4-1KF	
R24	G501810520	R, "	200K	1/4W	±1%	RN1/4-200KF	
R25	G501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
C1	A502203024	C, Tantalum	1.5μ	16WV		CS15EICIR5M	
C2	A502203024	C, "	"	"		CS15EICIR5M	
C3	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C4	502103023	C, "	"	"		SM25VB-10	
C5	G502203014	C, Tantalum	15μ	16WV		CS15EIC150M	
C7	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
GR1	G503100020	Di, Si	V_R = 30V	I_F = 0.1A		IS953	
CR2	G503100020	Di, "	"	"		IS953	
IC1	503300149	Resistor Array				GT85A	
IC2	503300150	"				GT86A	
IC3	G503300054	IC, Op-Amp	Dual			NJM4558D	
IC4	G503300025	IC, "				TA7504P	NJM7410
S1	508102015	Switch, Toggle				3T201N-RIA	

Figure	Part No.	Description				Type	Remarks
TB1	B513400027	Test Terminal				LC-1 G	
TB2	B513400027	"				LC-1-G	
TB3	B513400027	"				LC-1-G	
PCB	511310060	Printed Circuit Board				3101-06C	
PC1	A503300108	Photo Coupler	I_F= 70mA	I_C= 100mA		NJL5103D	
			60% ≤ CTR ≤ 150%				
Q1	G503200015	T, NPN	3A	60V	1.5W	2SD234, O	
Q2	503203014	T, NPN	30V	100mA	200mW	2SC1815, Y	2SC373
J1	A513200201	Connector, Socket	2P			S-I0320	
P2	513400049	Connector, Pin Header	7P			HNC2-2.5P.7DS	
J2	513400047	Connector, Receptacle	7P			HNC2-2.5S7	
CNP	513400042	Contact Pin				HNC-2.5S-B	x 6, For J2
	B520100012	Insulating Sheet				30B6001	
	B520100013	Insulating Washer				AC316A	
R10	501810247	R, Metal Film	470	1/4W	±1%	RN1/4-470F	For Type S
"	501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	For Type W
R16	505103711	R, Trimmer Cermet	1K			RJ6X-1K	For Type S
"	504103009	R, "	2K			RJ6X-2K	For Type W

Heat Control Circuit (New Type)



Note 1)

	S	W
R10	470Ω	1K
R16	1K	2K

Note 2)

TB3 : -1.25V at 10cm/s
-3.3V at 100cm/s

Heat Control Circuit (New Type)

Figure	Part No.	Description				Type	Remarks
R1	501810336	R, Metal Film	3.6K	1/4W	±1%	RN1/4-3.6KF	
R2	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R3	G501304701	R, "	15	1/2W	±5%	RNE1/2-15J	
R4	501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R5	G501810327	R, "	2.7K	1/4W	±1%	RN1/4-2.7KF	
R6	G501810336	R, "	3.6K	1/4W	±1%	RN1/4-3.6KF	
R7	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R8	501810227	R, "	270	1/4W	±1%	RN1/4-270J	
R9	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R11	G501810410	R, Metal Film	10K	1/4W	±1%	RN1/4-10KF	
R12	G501810418	R, "	18K	1/4W	±1%	RN1/4-18KF	
R13	G501810510	R, Solid	100K	1/4W	±1%	RN1/4-100KF	
R14	G501810351	R, Metal Film	5.1K	1/4W	±1%	RN1/4-5.1KF	
R17	G504207031	R, Metal Film	20K			TM10KPH-20K	
R18	G504207031	R, "	20K			TM10KPH-20K	
R19	A505103023	R, Trimmer Cermet	20K			RJ6X-20K	
R20	G505103011	R, "	1K			RJ6X-1K	
R21	504103021	R, Variable Carbon	10K			RV16YP20SB10K	
R22	B503400005	R, Thermister	10K			10KD7-15%	
R23	501810310	R, Solid	1K	1/4W	±1%	RN1/4-1KF	
R24	G501810520	R, Metal Film	200K	1/4W	±1%	RN1/4-200KF	
R25	G501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
C1	502203024	C, Tantalum	1.5μ	20WV		CS15EIDIR5M	
C2	502203024	C, "	"	"		CS15EIDIR5M	
C3	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C4	502103023	C, "	"	"		SM25VB-10	
C8	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C9	502103023	C, "	"	"		SM25VB-10	
CR1	G503100020	Di, Si	V_R = 30V		I_F = 0.1A	IS953	
CR2	G503100020	Di, "	"		"	IS953	
IC1		IC, Hybrid				WS-1801	
IC3	G503300054	IC, Op-Amp	Dual			NJM4558D	
IC4	G503300025	IC, "				TA7504P	NJM7410
S1	508102015	Switch, Toggle				3T201N-RIA	
TB1	B513400027	Test Terminal				LC-1-G	
TB2	B513400027	"				LC-1-G	
TB3	B513400027	"				LC-1-G	

Figure	Part No.	Description	Type	Remarks
PCB	511310060	Printed Circuit Board	3101-06E	
PC1	A503300108	Photo Coupler I_F = 70mA I_C = 100mA 60% ≤ CTR ≤ 150%	NJL5103D	
Q1	G503200015	T, NPN 3A 60V 1.5W	2SD234, O	
Q2	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
J1	A513200201	Connector, Socket 2P	S-I0320	
P2	513400049	Connector, Pin Header 7P	HNC2-2.5P.7DS	
J2	513400047	Connector, Receptacle 7P	HNC2-2.5S7	
CNP	513400042	Contact Pin	HNC-2.5S-B	x 6, For J2
	B520100012	Insulating Sheet	30B6001	
	B520100013	Insulating Washer	AC316A	
R10	501810247	R, Metal Film 470 1/4W ±1%	RN1/4-470F	For Type S
"	501810310	R, " 1K 1/4W ±1%	RN1/4-1KF	For Type W
R16	505103711	R, Trimmer Cermet 1K	RJ6X-1K	For Type S
"	504103009	R, " 2K	RJ6X-2K	For Type W

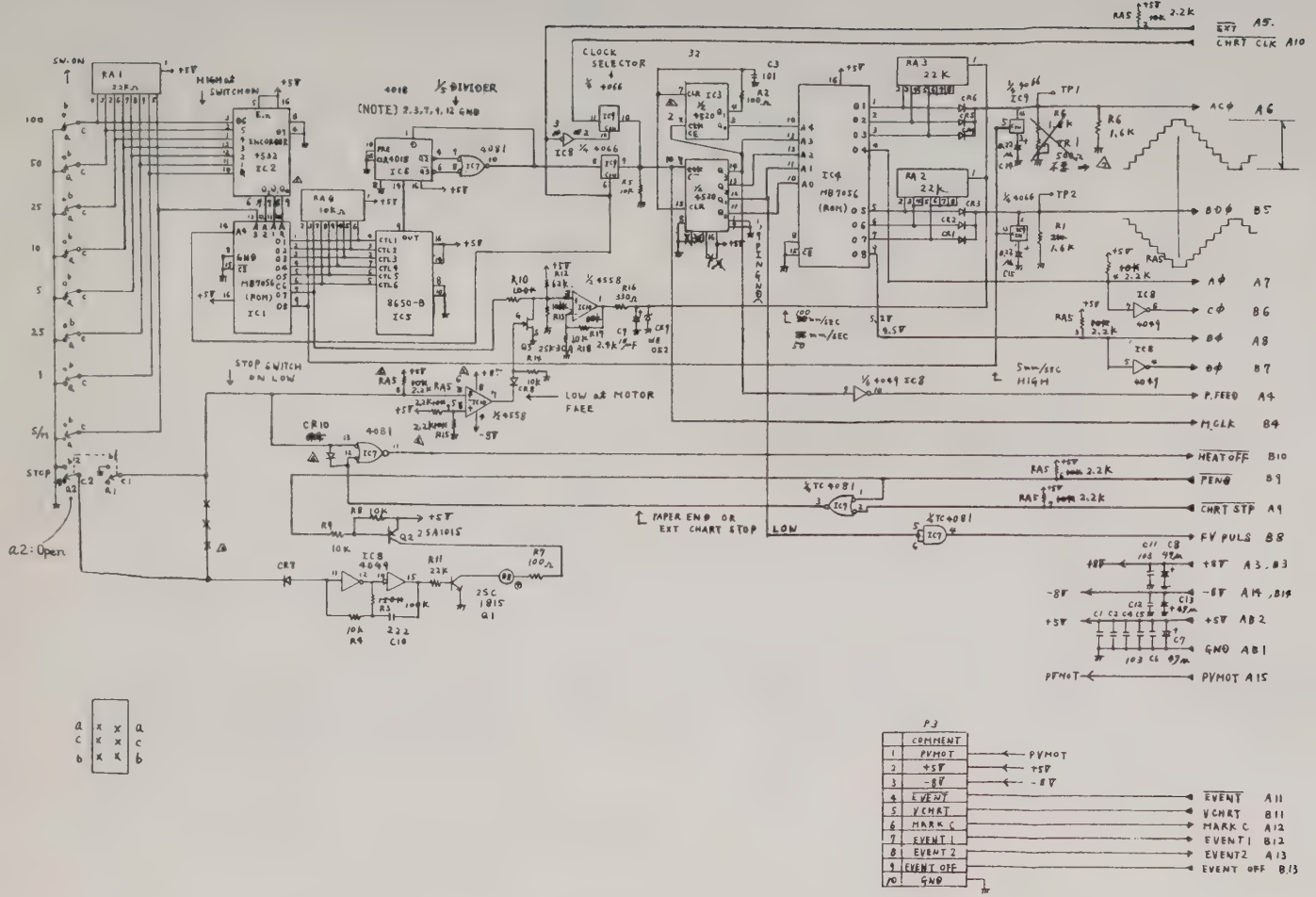

SW-ON
RA1
22K
HIGH at SWITCH ON
+5V
100
50
25
10
5
2.5
1
S/m
STOP
a2: Open
IC2
ENCODER
5532
IC1
MB7056
(ROM)
RA6
10K
IC6
4018
1/5 DIVIDER
(NOTE) 2,3,7,1,12 GND
4081
IC7
IC5
8650-B
CLOCK SELECTOR
1/4066
IC8
IC3
4520
C3
101
A2
100
IC4
MB7056
(ROM)
RA3
22K
RA2
22K
TP1
TP2
R6
1.6K
R1
1.6K
VR1
50K
RAS
2.2K
EXT A5.
CHRT CLK A10
AC$ A6
BD$ B5
A$ A7
C$ B6
B$ A8
D$ B7
P.FEED A4
M.CLK B4
HEAT OFF B10
PEN$ B9
CHRT STP A9
FV PULS B8
+5V A3, B3
-8V A14, B14
+5V AB2
GND AB1
PVMOT A15
P2
COMMENT | A | B | COMMENT
GND | 1 | | GND
+5V | 2 | | +5V
+8V | 3 | | +25
PFEED | 4 | | MCLK
EXT | 5 | | BD$
AC$ | 6 | | C$
A$ | 7 | | B$
B$ | 8 | | FV PULS
CHRT STP | 9 | | PEN$
CHRT CLK | 10 | | HEAT OFF
EVENT | 11 | | VCHRT
MARK C | 12 | | EVENT1
EVENT 2 | 13 | | EVENT OFF
-8V | 14 | | -8V
PVMOT | 15 | |
P3
1 COMMENT
1 PVMOT ← PVMOT
2 +5V ← +5V
3 -8V ← -8V
4 EVENT → EVENT A11
5 VCHRT → VCHRT B11
6 MARK C → MARK C A12
7 EVENT 1 → EVENT1 B12
8 EVENT 2 → EVENT2 A13
9 EVENT OFF → EVENT OFF B13
10 GND
STOP SWITCH ON LOW
LOW at MOTOR FAEE
PAPER END OR EXT CHART STOP
LOW
CR10
CR7
CR8
CR9
R9
10K
Q2 2SA1015
R8 10K
R7 100Ω
R11 22K
R5 100K
IC8 4049
2SC 1815 Q1
10A R9
222 C10
R10 100Ω
R12 82K
R13 10K
R14 2.9K
R15 10K
R16 330Ω
R17 10K
R18 2.9K
R19 10K
Q3 2SK30A
Q4 2SK30A
C9 1/F
C11 C8 104 .1
C12 C13 47
C1 C2 C4 C5
C7 103 .01
100 mm/sec
50 mm/sec
5.2V
8.5V
5mm/sec HIGH
IC9 4066
IC9 4081
IC8 4049
1/4 4069 IC8
1/4 4558
1/4 4066
TC 4081
a c x x b
x x x x
a c b

Chart Controller

Figure	Part No.	Description	Type	Remarks
IC1	503303432	IC, NMOS Bipolar Memory	MB7056D	
IC2	503300118	IC, CMOS Encorder	TC4532BP	
IC3	503303431	IC, CMOS Counter	TC4520BP	
IC4	503300148	IC, NMOS Bipolar Memory	MB7056B	
IC5	503303407	IC, CMOS Programable Divider	8650B	
IC6	503300119	IC, CMOS Divide-By-N Counter	TC4018BP	
IC7	503303371	IC, CMOS And	TC4081BP	
IC8	503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC9	503300052	IC, CMOS Dual Bilateral Switch	TC4066BP	
IC10	503300054	IC, Op-Amp Dual	NJM4558D	
Q1	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q2	503203016	T, PNP −30V −100mA 200mW	2SA1015, Y	
Q3	503200027	T, N-J-FET	2SK30A	
RA1	501002811	Resister Array 22K	RM8-223	
RA2	501002811	" "	RM8-223	
RA3	501002811	" "	RM8-223	
RA4	501002813	" 10K	RM8-103	
RA5	501002810	" 2.2K	RM8-222	
CR1	503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR2	503100020	Di, " " "	IS953	
CR3	503100020	Di, " " "	IS953	
CR4	503100020	Di, " " "	IS953	
CR5	503100020	Di, " " "	IS953	
CR6	503100020	Di, " " "	IS953	
CR7	503100020	Di, " " "	IS953	
CR8	503100020	Di, " " "	IS953	
CR9	503100060	Di, Zener 5.2V 0.5W ±5%	WZ052	
CR10	503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
R1	501810316	R, Metal Film 1.6K 1/4W ±1%	RN1/4-1.6KF	
R2	501810210	R, " 100 1/4W ±1%	RN1/4-100F	
R3	501810510	R, " 100K 1/4W ±1%	RN1/4-100KF	
R4	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R5	501810410	R, " " " "	RN1/4-10KF	
R6	501810316	R, " 1.6K 1/4W ±1%	RN1/4-1.6KF	
R7	501810210	R, " 100 1/4W ±1%	RN1/4-100F	
R8	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R9	501810410	R, " " " "	RN1/4-10KF	
R10	501810510	R, " 100K 1/4W ±1%	RN1/4-100KF	
R11	501810422	R, " 22K 1/4W ±1%	RN1/4-22KF	
R12	501810462	R, " 62K 1/4W ±1%	RN1/4-62KF	
R13	501810510	R, " 100K 1/4W ±1%	RN1/4-100KF	
R14	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	

Figure	Part No.	Description			Type	Remarks
R15	501810322	R, Metal Film	2.2K	1/4W ±1%	RN1/4-2.2KF	
R16	501810233	R, "	330	1/4W ±1%	RN1/4-330F	
R17	501810324	R, "	2.4K	1/4W ±1%	RN1/4-10KF	
R18	501810410	R, "	10K	1/4W ±1%	RN1/4-10KF	
C1	502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C2	502403007	C, "	"	"	ULD06-103-L2A	
C3	502403009	C, "	100P	50WV	UFD04-101K-K2J	
C4	502403007	C, "	0.01μ	50WV	ULD06-103-L2A	
C5	502403007	C, "	"	"	ULD06-103-L2A	
C6	502403007	C, "	"	"	ULD06-103-L2A	
C7	5021-2026	C, Electrolytic	47μ	16WV	ECEAICS470	
C8	502102026	C, "	"	"	ECEAICS470	
C9	502203002	C, Tantalum	10μ	15WV	CS15EIC100M	
C10	502303001	C, Myler Film	0.0022μ	50WV	MFL-05D22	
C11	502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C12	502403007	C, "	"	"	ULD06-103-L2A	
C13	502102026	C, Electrolytic	47μ	16WV	ECEAICS470	
C14	502203012	C, Tantalum	0.22μ	35WV	CS15EIVR22M	
C15	502203012	C, "	"	"	CS15EIVR22M	
S1	508201018	Switch Push			2UEE	
S2	508201018	"			2UEE	
S3	508207001	"			KSD7-14-10ILDC	
CAP	516100020	Cap Black			B911	x 8
CAP	516100025	Cap Ivory			B201	
TP1	513400027	Test Terminal			LC-1-G	
TP2	513400027	"			LC-1-G	
P2	513301010	Connector Pin Header	30P		PS30PED4TIPNI	
P3	513400068	Connector Pin Header	10P		HNC2-2.5P-10DSL	
BZ	519300001	Buzzer			SD161201	
PCB	511370020	Printed Circuit Board			PR3701-02	

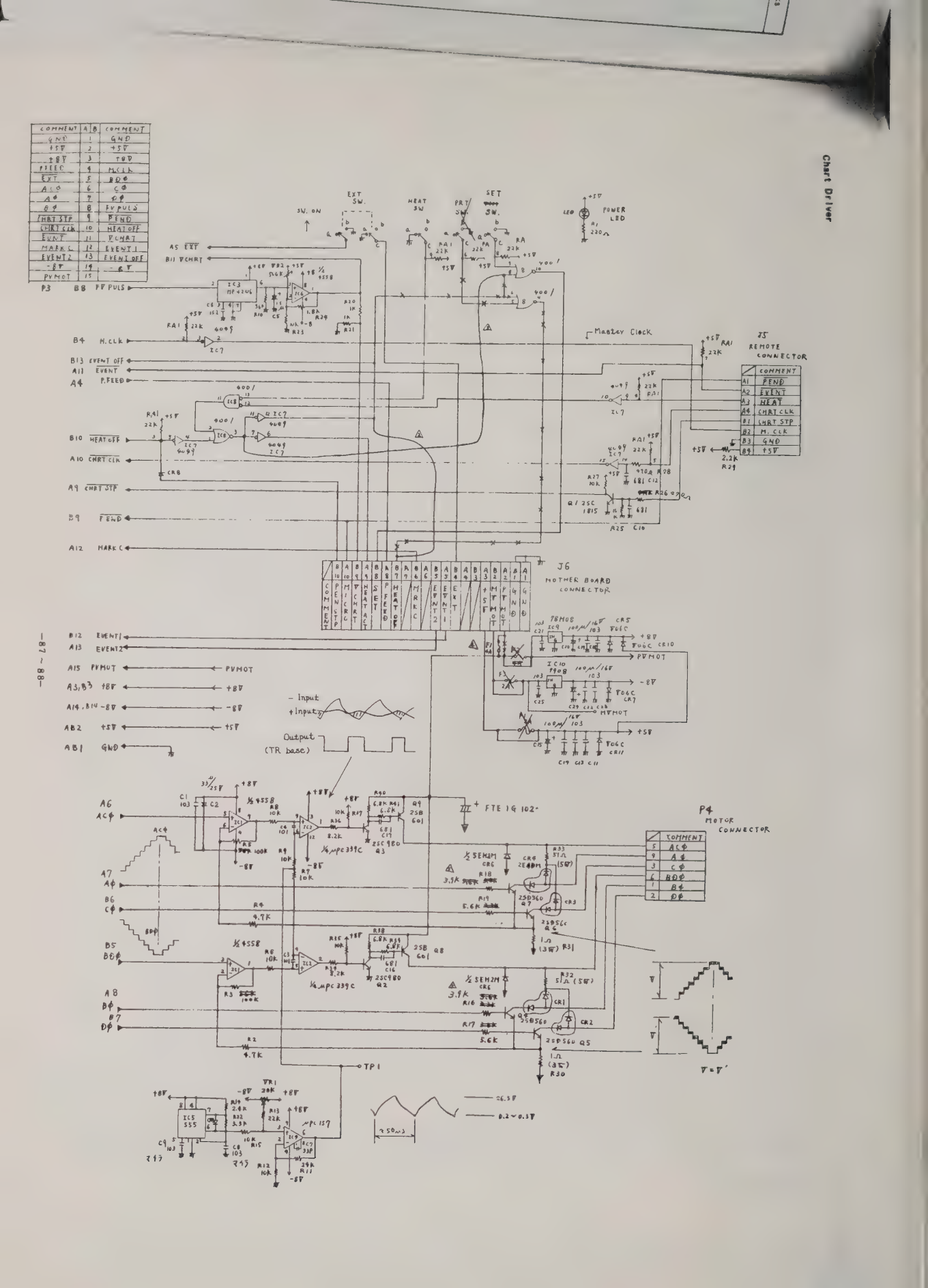
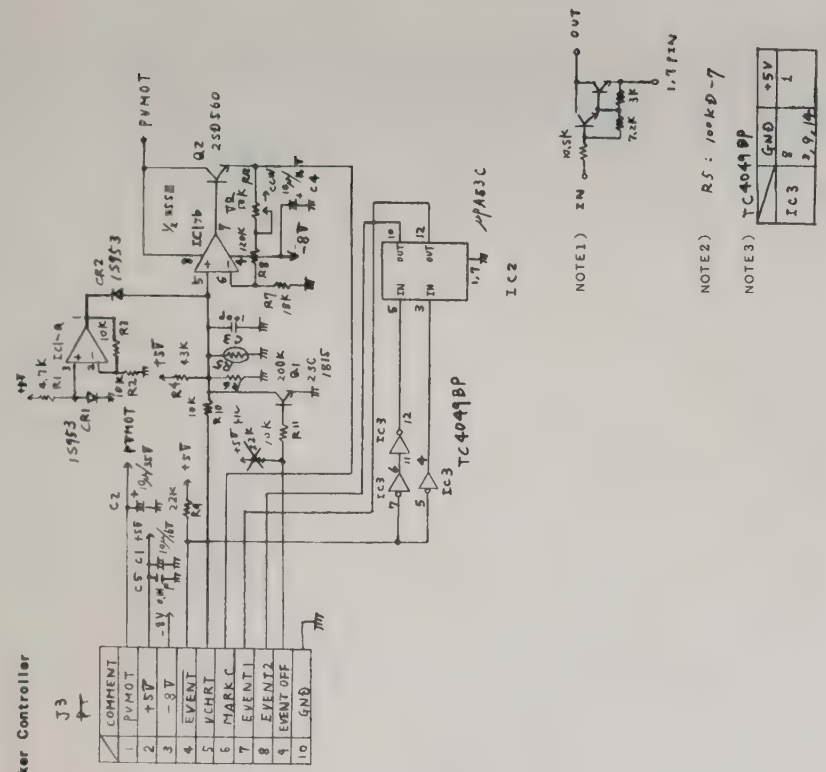

P3
COMMENT | A | B | COMMENT
GND | 1 | | GND
+5V | 2 | | +5V
+8V | 3 | | +8V
FEED | 4 | | MCLK
EXT | 5 | | BDΦ
ACΦ | 6 | | CΦ
AΦ | 7 | | DΦ
BΦ | 8 | | FV PULS
CHRT STP | 9 | | FEND
CHRT CLK | 10 | | HEAT OFF
EVNT | 11 | | V CHRT
MARK C | 12 | | EVENT 1
EVENT 2 | 13 | | EVENT OFF
-8V | 14 | | -8V
PVMOT | 15 | |
SW. ON
EXT SW.
HEAT SW
PRT SW
SET SW.
POWER LED
Master Clock
J5 REMOTE CONNECTOR
J6 MOTHER BOARD CONNECTOR
P4 MOTOR CONNECTOR
78M08
FTE 1G 102
TP1
- Input
+ Input
Output (TR base)
26.5V
0.2 ~ 0.3V
750mS
V = V'

Chart Driver

Figure	Part No.	Description				Type	Remarks
IC1	503300054	IC, OP-Amp. Dual				NJM 4558D	
IC2	503300121	IC, Comparator				μPC 339C	
IC3	503300122	IC, F/V Convertor				MB 4206	
IC4	503300123	IC, OP-Amp.				μPC 157	
IC5	503300030	IC, Timer				NE 555	
IC6	503300054	IC, OP-Amp. Dual				NJM 4558D	
IC7	503300094	IC, CMOS Inverting Buffer				TC 4049 BP	
IC8	503300124	IC, " 2In-Nor				TC 4001 BP	
IC9	503301049	IC, Voltage Regulator	8V			μPC 78M08	
IC10	503301141	IC, " "	-8V			μPC 7908	
Q1	503203014	T, NPN	30V	100mA	200mW	2SC1815, Y	
Q2	503204017	T, "	70V	100mA	400mW	2SC980, O	
Q3	"	T, "	"	"		"	
Q4	503200028	T, "	100V	5A	1.5W	2SD560, L, NEC	
Q5	"	T, "		"		"	
Q6	"	T, "		"		"	
Q7	"	T, "		"		"	
Q8	503203018	T, PNP	-100V	-5V	1.5W	2SB701, L, NEC	
Q9	"	T, "		"		"	
CR1	503100063	Di, Si Diode Module				2EADM, NEC	
CR2	"	Di, "				"	
CR3	"	Di, "				"	
CR4	"	Di, "				"	
CR5	503100021	Di, Si V_R = 200V I_F = 1.1A				V06C	
CR6	503100066	Di, Si Diode Module				5EH2M, NEC	
CR7	503100021	Di, Si V_R = 200V I_F = 1.1A				V06C	
CR8	503100020	Di, Si V_R = 30V I_F = 100mA				IS953	
CR9	"	Di, "				"	
CR10	503100021	Di, Si V_R = 200V I_F = 1.1A				V06C	
CR11	"	Di, "				"	
LED	512100018	Di, LED, RED I_F = 30mA				SLB 26 VR	
RA1	501002811	Resistor Array	22K			RM8-223	
R1	501810222	R, Metal Film	220	1/4W	±1%	RN1/4-220F	
R2	501810347	R, "	4.7K	1/4W	±1%	RN1/4-4.7KF	
R3	501810510	R, "	100K	1/4W	±1%	RN1/4-100KF	
R4	501810347	R, "	4.7K	1/4W	±1%	RN1/4-4.7KF	
R5	501810510	R, "	100K	1/4W	±1%	RN1/4-100KF	
R6	501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
R7	"	R, "		"		"	
R8	"	R, "		"		"	

Figure	Part No.	Description	Type	Remarks
R9	501810410	R, Metal Film 10K 1/4W ±1%	RN1/4-10KF	
R10	501810456	R, Metal Film 56K 1/4W ±1%	RN1/4-56KF	
R11	501810424	R, " 24K 1/4W ±1%	RN1/4-24KF	
R12	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R13	501810422	R, " 22K 1/4W ±1%	RN1/4-22KF	
R14	501810324	R, " 2.4K 1/4W ±1%	RN1/4-2.4KF	
R15	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R16	501810356	R, " 3.9K 1/4W ±1%	RN1/4-3.9KF	
R17	"	R, " 5.6K "	RN1/4-5.6KF	
R18	"	R, " 3.9K "	RN1/4-3.9KF	
R19	"	R, " 5.6K "	RN1/4-5.6KF	
R20	501810310	R, " 1K 1/4W ±1%	RN1/4-1KF	
R21	"	R, " "	"	
R22	501810333	R, " 3.3K 1/4W ±1%	RN1/4-3.3KF	
R23	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R24	501810318	R, " 1.8K 1/4W ±1%	RN1/4-1.8KF	
R25	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R26	501810247	R, " 470 1/4W ±1%	RN1/4-470F	
R27	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R28	501810247	R, " 470 1/4W ±1%	RN1/4-470F	
R29	501810322	R, " 2.2K 1/4W ±1%	RN1/4-2.2KF	
R30	501609732	R, " 1Ω 3W ±5%	RSF 3B-1J	
R31	"	R, " "	"	
R32	501609724	R, Wirewound 51Ω 5W ±5%	MV5P-51J	
R33	"	R, " " " "	"	
R34	501810382	R, Metal Film 8.2K 1/4W ±1%	RN1/4-8.2KF	
R35	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R36	501810382	R, " 8.2K 1/4W ±1%	RN1/4-8.2KF	
R37	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R38	501810368	R, " 6.8K 1/4W ±1%	RN1/4-6.8KF	
R39	"	R, " "	"	
R40	"	R, " "	"	
R41	"	R, " "	"	
VR1	505102027	R, Trimmer, Cermet 20K	GF6P-20K	
VR2	505103029	R, " " 500K	GF6P-500K	
C1	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
C2	502102027	C, Electrolytic 33μ 25WV	ECEA1IS330	
C3	502403029	C, Ceramic 100P 50WV	UFD04SA101J-L0B	
C4	"	C, " " "	"	
C5	502203024	C, Tantalum 1.5μ 16WV	CS1SE1C1R5M	
C6	502303019	C, Myler Film 0.0015μ 50WV	MFL-05D15	
C7	502403034	C, Ceramic 33P 50WV	RAU04SL330KL05AE	
C8	502303004	C, Myler Film 0.01μ 50WV	MFL-05S1	

Figure	Part No.	Description	Type	Remarks
C9	502303004	C, Myler Film 0.01μ 50WV	MFL-05S1	
C10	502403036	C, Ceramic 680P 50WV	UFD04SA681J-L0B	
C11	502403007	C, " 0.01μ 50WV	ULD06-103-L2A	
C12	502403036	C, " 680P 50WV	UFD04SA681J-L0B	
C13	502403007	C, " 0.01μ 50WV	ULD06-103-L2A	
C14	"	C, " " "	"	
C15	502103048	C, Electrolytic 100μ 16WV	ECEA1CS101	
C16	502403036	C, Ceramic 680P 50WV	UFD04SA681J-L0B	
C17	"	C, " " "	"	
C18	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
C19	"	C, " " "	"	
C20	502103048	C, Electrolytic 100μ 16WV	ECEA1CS101	
C21	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
C22	"	C, " " "	"	
C23	"	C, " " "	"	
C24	502103048	C, Electrolytic 100μ 16WV	ECEA1CS101	
C25	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
FTE	502403037	C, Electroric 1000μ 50WV	FTE1G102	
F1	512300025	Fuse 4A	MC-4	
S1	508201010	Switch Push	2UOA	SET
S2	508201018	Switch Push	2UEE	HEAT.EXT
P3	513301010	Connector Pin Header 30P	PS30PED4T1PN1	
P4	513400046	" " " 6P	HNC2-2.5P-6DSL02	
J5	513400109	Connector Pin Header 8P	FCN-365P008AG	
J6	513300604	" Card Edge	225J21021-487	
TP1	513400027	Check Pin	LC-1-G	
CAP	516100020	Cap Black	B911	
PCB	511370130	Printed Circuit Board	PR3701-13	



Event Marker Controller

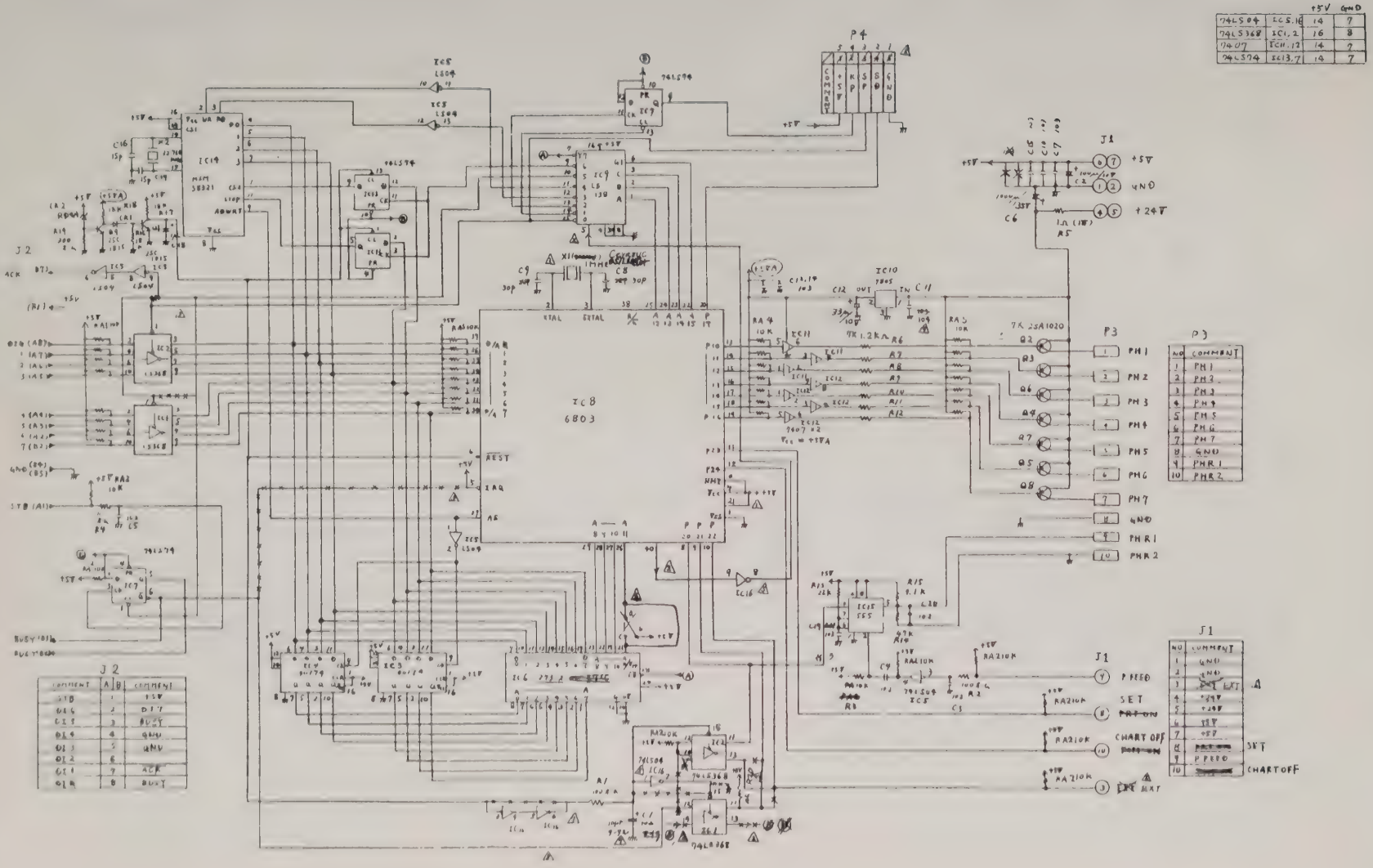
Event Marker Controller

Figure	Part No.	Description	Type	Remarks
IC1	503300054	IC, OP-Amp Dual	JNM4558D	
IC2	503300053	IC, Darlington Transistor Array	UPA53C	
IC3	503300093	IC, CMOS Inverting Buffer	TC4049BP	
CR1	503100020	SD, Si V_R = 30V I_F = 100mA	1S953	
CR2	"	" " " "	"	
C1	502103040	C, Electrolytic 10µ 16WV	ECEA1CS100	
C2	502103051	C, " 10µ 35WV	ECEA1VS100	
C3	502403009	C, Ceramic 100P 50WV	UFD04-101K-K2J	
C4	502103040	C, Electrolytic 10µ 16WV	ECEA1CS100	
C5	502403007	C, Ceramic 0.01µ 50WV	ULD06-103-L2A	
R1	501810347	R, Metal Film 4.7K 1/4W ±1%	RN1/4-4.7KF	
R2	501810410	R, " 10K 1/4W "	RN1/4-10KF	
R3	"	R, " " " "	"	
R4	501810443	R, " 43K " "	RN1/4-43KF	
R5	503103012	R, Thermister 100K	100KD-7	
R6	501810520	R, Metal Film 200K 1/4W ±1%	RN1/4-200KF	
R7	501810418	R, " 18K " "	RN1/4-18KF	
R8	501810512	R, " 120K " "	RN1/4-120KF	
R9	501810422	R, " 22K " "	RN1/4-22KF	
R10	501810410	R, " 10K " "	RN1/4-10KF	
R11	"	R, " " " "	"	
R12	505103027	R, Trimmer Cermet 50K	GF06P-50K	
Q1	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q2	503200028	T, NPN 100V 5A 1.5W	2SD560	
	520100012	Insulating Sheet	30B6001	For Q2
	520100013	" Washer	AC316A	For Q2
J3	513400072	Connector, Receptacle 10P	HNC2-2.5S-10	
CNP	513400042	Contact Pin	HNC-2.5S-B	For J3
PCB	511370210	Printed Circuit Board	PR3701-21	

Event Marker Controller

Figure	Part No.	Description	Type	Remarks
IC1	503300054	IC, OP-Amp Dual	JNM4558D	
IC2	503300053	IC, Darlington Transistor Array	UPA53C	
IC3	503300093	IC, CMOS Inverting Buffer	TC4049BP	
CR1	503100020	SD, Si V_R = 30V I_F = 100mA	1S953	
CR2	"	" " " "	"	
C1	502103040	C, Electrolytic 10μ 16WV	ECEA1CS100	
C2	502103051	C, " 10μ 35WV	ECEA1VS100	
C3	502403009	C, Ceramic 100P 50WV	UFD04-101K-K2J	
C4	502103040	C, Electrolytic 10μ 16WV	ECEA1CS100	
C5	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
R1	501810347	R, Metal Film 4.7K 1/4W ±1%	RN1/4-4.7KF	
R2	501810410	R, " 10K 1/4W "	RN1/4-10KF	
R3	"	R, " " " "	"	
R4	501810443	R, " 43K " "	RN1/4-43KF	
R5	503103012	R, Thermister 100K	100KD-7	
R6	501810520	R, Metal Film 200K 1/4W ±1%	RN1/4-200KF	
R7	501810418	R, " 18K " "	RN1/4-18KF	
R8	501810512	R, " 120K " "	RN1/4-120KF	
R9	501810422	R, " 22K " "	RN1/4-22KF	
R10	501810410	R, " 10K " "	RN1/4-10KF	
R11	"	R, " " " "	"	
R12	505103027	R, Trimmer Cermet 50K	GF06P-50K	
Q1	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q2	503200028	T, NPN 100V 5A 1.5W	2SD560	
	520100012	Insulating Sheet	30B6001	For Q2
	520100013	" Washer	AC316A	For Q2
J3	513400072	Connector, Receptacle 10P	HNC2-2.5S-10	
CNP	513400042	Contact Pin	HNC-2.5S-B	For J3
PCB	511370210	Printed Circuit Board	PR3701-21	

Printer Controller



		+5V	GND
74LS04	IC5.16	14	7
74LS368	IC1, 2	16	8
7407	IC11, 12	14	7
74LS74	IC13, 7	14	7

J2			
COMMENT	A	B	COMMENT
STB	1		+5V
DATA	2		DTR
DATA	3		BUSY
DATA	4		GND
DATA	5		+5V
DATA	6		
DATA	7		ACK
DATA	8		BUSY

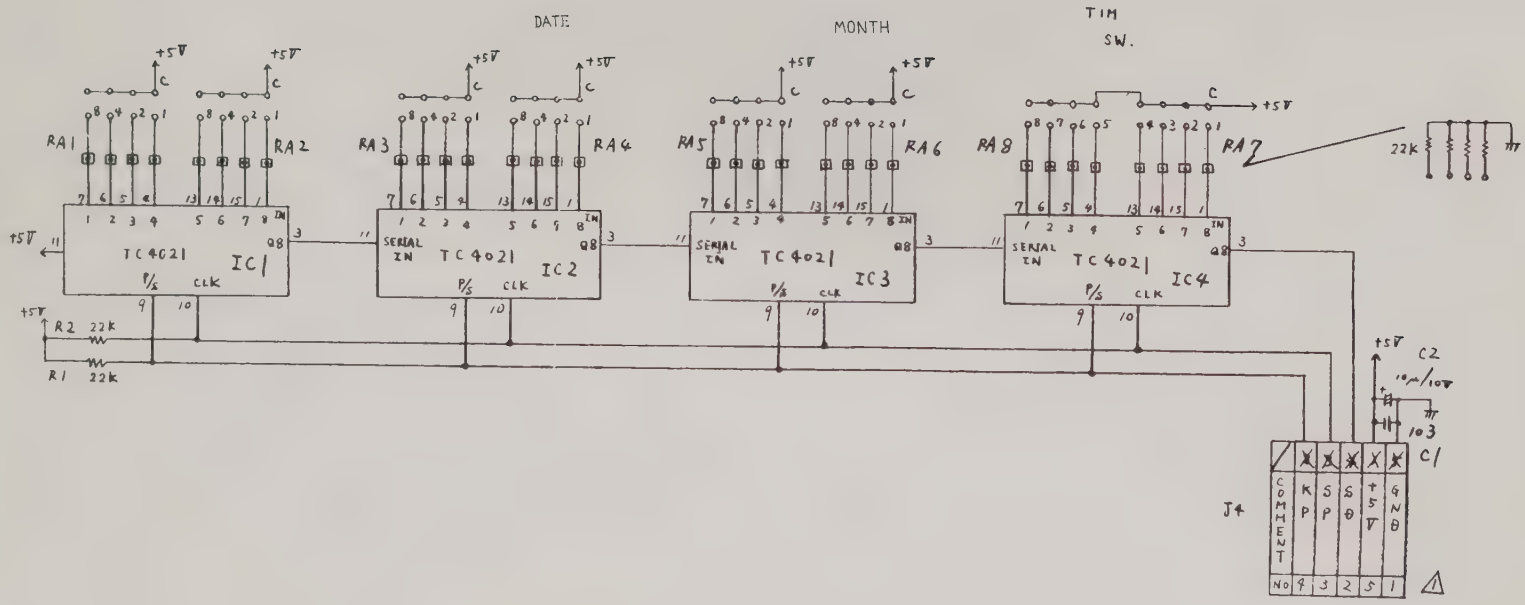
P3	
NO	COMMENT
1	PH1
2	PH2
3	PH3
4	PH4
5	PH5
6	PH6
7	PH7
8	GND
9	PHR1
10	PHR2

J1	
NO	COMMENT
1	GND
2	GND
3	RESET
4	+24V
5	+24V
6	+5V
7	+5V
8	SET
9	P FEED
10	CHART OFF

Printer Controller

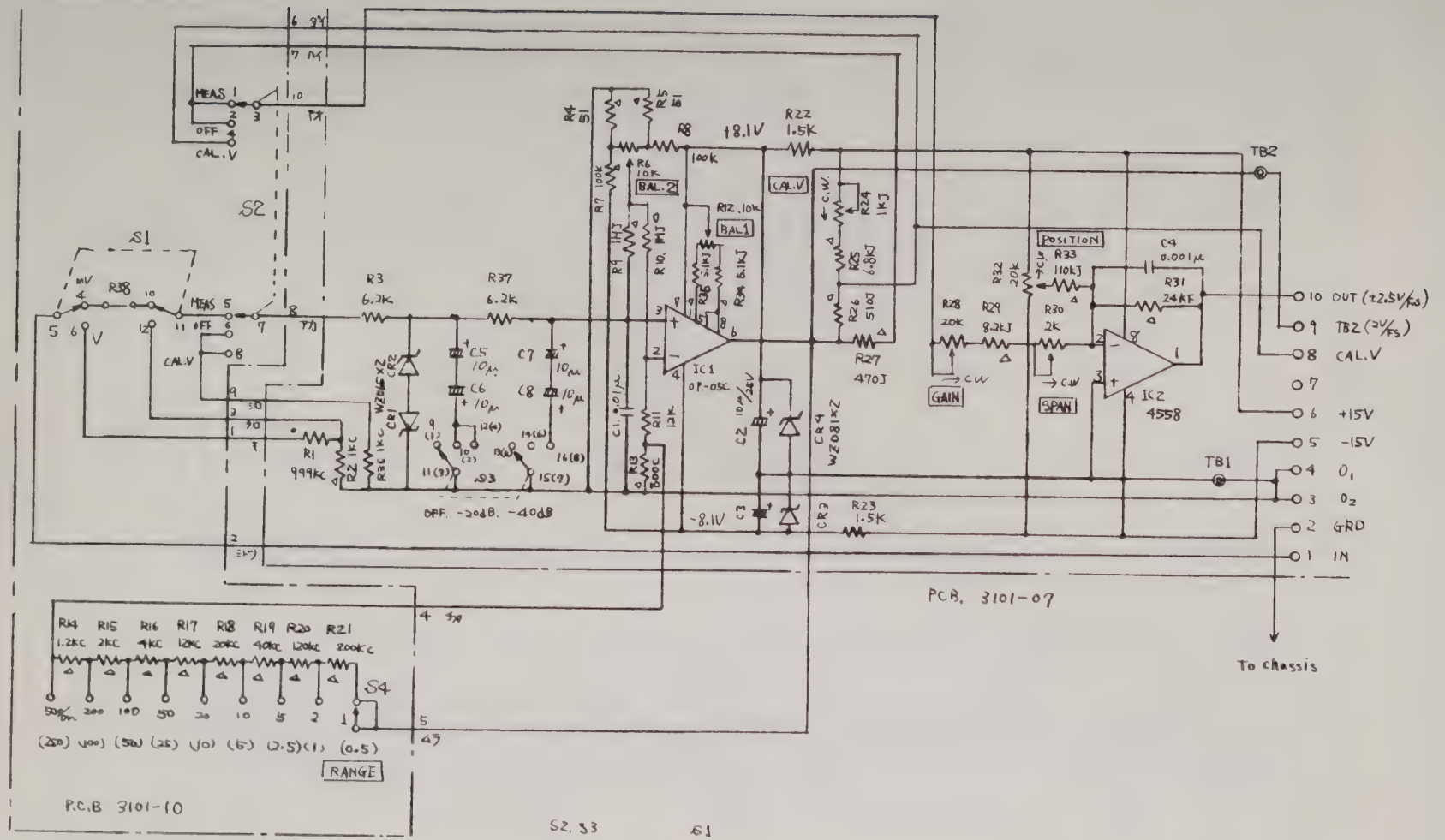
Figure	Part No.	Description	Type	Remarks
IC1	503303300	IC, TTL Hex Bus Drivers	SN74LS368	
IC2	"	IC, " "	"	
IC3	503300141	IC, CMOS Hex Type D Flip-Flop	TC40174BP	
IC4	"	IC, " "	"	
IC5	503300125	IC, TTL Hex Inverter	SN741S04	
IC6	503300133	IC, NMOS EP-ROM	MB8516	
IC7	503300137	IC, TTL Dual D-FF	SN74LS74	
IC8	503303435	IC, NMOS CPU	HD6803, CPU	
IC9	503303120	IC, TTL 3-To-8 Line Decoders	SN74LS138	
IC10	503300128	IC, Voltage Regulator 5V	μPC7805H, NEC	
IC11	503300136	IC, TTL Hex Buffer O.C.	SN7407	
IC12	"	IC, " "	"	
IC13	503300137	IC, " Dual D-FF	SN74LS74	
IC14	503303434	IC, Real Time Clock	MSM58321RS	
IC15	503300030	IC, Timer	NE555	
IC16	503300125	IC, TTL Hex Inverter	SN74LS04	
Q1	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y.	
Q2	503203019	T, PNP -50V -2A 900mW	2SA1020, Y.	
Q3	"	T, " "	"	
Q4	"	T, " "	"	
Q5	"	T, " "	"	
Q6	"	T, " "	"	
Q7	"	T, " "	"	
Q8	"	T, " "	"	
Q9	503203014	T,NPN 30V 100mA 200mW	2SC1815, Y	
CR1	503100020	Di, Si V_R = 30V I_F = 100mA	1S953	
CR2	503100068	Di, Zener 4.0V 0.5W ±5%	RD4A, NEC	
RA1	501002813	Resister Array 10K	RM8-103	
RA2	"	" " "	"	
RA3	"	" " "	"	
RA4	"	" " "	"	
RA5	"	" " "	"	
R1	501810210	R, Metal Film 100 1/4W ±1%	RN1/4-100F	
R2	501810210	R, " 100 1/4W ±1%	RN1/4-100F	
R3	501810410	R, " 10K 1/4W ±1%	RN1/4-10KF	
R4	501810210	R, " 100 1/4W ±1%	RN1/4-100F	
R5	501605711	R, " 1 2W ±5%	RSF1B-1J	
R6	501810312	R, " 1.2K 1/4W ±1%	RN1/4-1.2KF	
R7	"	R, " "	"	
R8	"	R, " "	"	
R9	"	R, " "	"	

Figure	Part No.	Description				Type	Remarks
R10	501810312	R, Metal Film	1.2K	1/4W	±1%	RN1/4-1.2KF	
R11	〃	R, 〃		〃		〃	
R12	〃	R, 〃		〃		〃	
R13	501810422	R, 〃	2.2K	1/4W	±1%	RN1/4-2.2KF	
R14	501810447	R, 〃	47K	1/4W	±1%	RN1/4-47KF	
R15	501810391	R, 〃	9.1K	1/4W	±1%	RN1/4-9.1KF	
R16	501810418	R, 〃	18K	1/4W	±1%	RN1/4-18KF	
R17	〃	R, 〃		〃		〃	
R18	〃	R, 〃		〃		〃	
R19	501810233	R, 〃	330	1/4W	±1%	RN1/4-330F	
R20	501810410	R, 〃	10K	〃	〃	RN1/4-10KF	
C1	502203002	C, Tantalum	10μ	16WV		CS15E1C100M	
C2	502103034	C, Electrolytic	100μ	10WV		ECEA1AS101	
C3	502403015	C, Ceramic	1000P	50WV		ULD06-102	
C4	502303002	C, Myler Film	1000P	50WV		MFL-05D1	
C5	502403015	C, Ceramic	1000P	50WV		ULD06-102	
C6	502103049	C, Electrolytic	1000μ	35WV		ECEB1VS102	
C7	502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C8	502703009	C, Mica	30P	100WV		Z05-100V30PF	
C9	〃	C, 〃	〃	〃		〃	
C10	502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C11	〃	C, 〃	〃	〃		〃	
C12	502103050	C, Electrolytic	33μ	10WV		ECEA1AS330	
C13	502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C14	〃	C, 〃	〃	〃		〃	
C15	〃	C, 〃	〃	〃		〃	
C16	502703007	C, Mica	15P	100WV		Z05-100V15P	
C17	〃	C, 〃		〃		〃	
C18	502203013	C, Tantalum	1μ	35WV		CS15E1V010M	
C19	502303004	C, Myler Film	0.01μ	50WV		MFL-05S1	
C20	502303002	C, 〃	1000P	50WV		MFL-05D1	
P3	513400068	Connector Pin Header		10P		HNC2-2.5P-10DSL	
P4	513400045	〃 〃		5P		HNC2-2.5P-5DSL	
J11	513400072	〃 Receptacle		10P		HNC2-2.5S-10	
CNP	513400053	Contact Pin				HNC-2.5S-B	For J11
J2	513400050	Connector Receptacle		16P		FCN365P016-AG	
P2	513400051	〃 Plug		16P		FCN367J016-AG	
X1	502901014	Ceramic Oscillator 1MHz				CSA1M-G-M4	
X2	502901015	Crystal Oscillator 32.768KHz				KF38G-32.768K-1	
PCB	511370080	Printed Circuit Board				RP3T01-06B	


DATE
MONTH
TIM
SW.
RA1
RA2
RA3
RA4
RA5
RA6
RA8
RA7
22K
+5V
C
TC4021
IC1
IC2
IC3
IC4
SERIAL IN
Q8
P/S
CLK
R2 22K
R1 22K
C2
10m/10V
103
C1
J4
COMMENT
KP
SP
SΘ
+5V
GNΘ
No

Printer Switch & Print Head

Figure	Part No.	Description	Type	Remarks
IC1	503300131	IC, Shift Register	TC4021BP	
" 2	"	IC, " "	"	
" 3	"	IC, " "	"	
" 4	"	IC, " "	"	
RA1	501102745	Resister Array 22K	RKC1/8B422K	
RA2	"	" " "	"	
RA3	"	" " "	"	
RA4	"	" " "	"	
RA5	"	" " "	"	
RA6	"	" " "	"	
RA7	"	" " "	"	
RA8	"	" " "	"	
R1	501810422	R, Metal Film 22K 1/4W ±1%	RN1/4-22KF	
R2	"	R, " "	"	
C1	502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
C2	502203002	C, Tantalum 10μ 16WV	CS15E1C100M	
J4	513400044	Connector, Receptacle 5P	HNC2-2.5S-5	
CNP	513400042	Contact Pin	HNC-2.5S-B	For J4
	508401012	Switch	A7M-206-P2	
S1	508401013	Switch	A7M-2M-Pair	
	508401015	Switch Spacer	A7M-2PA	
S2	507111113	Switch Rotary	JRA1-12	
PCB	511370090	Printed Circuit Board	PR3701-09	
P.Head	597110001	Print Head 24V 1A	EUX-TP703AT	
J3	513400072	Connector Receptacle 10P	HNC2-2.5S-10	
J24	513300612	" Card Edge 10Px2	225J21021-488	



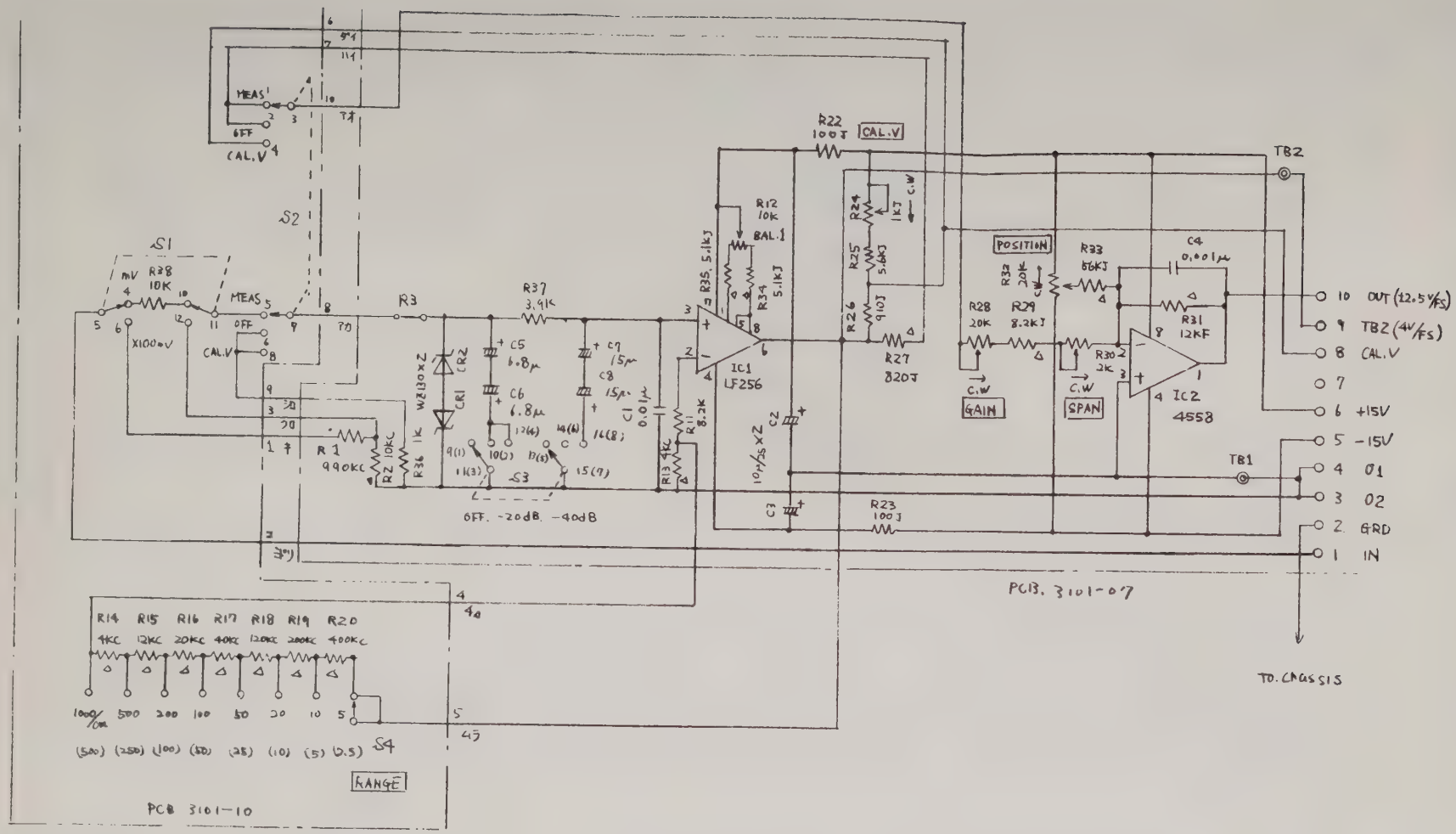
NOTE 1) MARK "•" : 25P.P.M/°c
MARK "○" : 100P.P.M/°c
2) TRIMER. R3C have been set zero ohm.
3) RANGE OF AH3102 : "( )"
4) R38 : SHORT

Pre Amplifier Type AH3101-1 AH3102-1

Figure	Part No.	Description				Type	Remarks
R1	G501503302	R, Metal Film	999K	1/2W	±0.25%	RN65E999KC	
R2	G501303301	R, "	1K	1/4W	±0.25%	RNE1/4-1KC	
R3	G501810362	R, "	6.2KF	1/4W	±1%	RN1/4-6.2KF	
R4	G501810151	R, "	51	1/4W	±1%	RN1/4-51F	
R5	G501810151	R, "	"	"	"	RN1/4-51F	
R6	G504207021	R, Trimmer Cermet		10K		TM10KPH-10K	
R7	G501810510	R, Metal Film	100K	1/4W	±1%	RN1/4-100KJ	
R8	G501810510	R, "	"	"	"	RN1/4-100KJ	
R9	G501810610	R, "	1M	1/4W	±1%	RN1/4-1MF	
R10	G501810610	R, "	"	"	"	RN1/4-1MF	
R11	G501810412	R, "	12K	1/4W	±1%	RN1/4-12KF	
R12	504207021	R, Trimmer Cermet		10K		TM10KFH-10K	
R13	501303315	R, Metal Film	800	1/4W	±0.25%	RNE1/4-800C	
R14	501303316	R, "	1.2K	1/4W	±0.25%	RNE1/4-1.2KC	
R15	501303317	R, "	2K	1/4W	±0.25%	RNE1/4-2KC	
R16	501303308	R, "	4K	1/4W	±0.25%	RNE1/4-4KC	
R17	501303309	R, "	12K	1/4W	±0.25%	RNE1/4-12KC	
R18	501303310	R, "	20K	1/4W	±0.25%	RNE1/4-20KC	
R19	501303311	R, "	40K	1/4W	±0.25%	RNE1/4-40KC	
R20	501303312	R, "	120K	1/4W	±0.25%	RNE1/4-120KC	
R21	501303313	R, "	200K	1/4W	±0.25%	RNE1/4-200KC	
R22	G501810315	R, "	1.5K	1/4W	±0.25%	RN1/4-1.5KF	
R23	G501810315	R, "	"	"	±0.25%	RN1/4-1.5KF	
R24	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R25	G501810368	R, Metal Film	6.8K	1/4W	±1%	RN1/4-6.8KF	
R26	G501810251	R, "	510	1/4W	±1%	RN1/4-510F	
R27	G501810247	R, "	470	1/4W	±1%	RN1/4-470F	
R28	504103015	R, Variable Carbon		20K		RV16YP20SB20K	
R29	G501810382	R, Metal Film	8.2K	1/4W	±1%	RN1/4-8.2KF	
R30	G504207022	R, Trimmer Cermet		2K		TM10KPH-2K	
R31	G501810424	R, Metal Film	24K	1/4W	±1%	RN1/4-24KF	
R32	504103015	R, Variable Carbon		20K		RV16YP20SB20K	
R33	G501810511	R, Metal Film	110K	1/4W	±1%	RN1/4-110KF	
R34	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R35	G501810351	R, "	"	"	"	RN1/4-5.1KF	
R36	G501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R37	G501810362	R, "	6.2K	1/4W	±1%	RN1/4-6.2KF	
C1	G502303004	C, Myler Film	0.01μ	50WV		MFL-05S1	
C2	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C3	502103023	C, "	"	"		SM25VB-10	
C4	G502303002	C, Myler Film	0.001μ	50WV		MFL-05D1	
C5	502204004	C, Tantalum	10μ	16V		CS15E1C100M1S-A	
C6	502204004	C, "	"	"		"	
C7	502204004	C, "	"	"		"	
C8	502204004	C, "	"	"		"	

Pre Amplifier Type AH3101-1 AH3102-1

Figure	Part No.	Description	Type	Remarks
IC1	A503300006	IC, OP-Amp	OP-05C	
IC2	A503300054	IC, " Dual	NJM4558D	
S1	508304008	Switch, Slide	SSA042L12	
S2	G508304002	Switch, Slide	SSA043L12	
S3	G508304003	Switch, Slide	SSA043L06	
S4	507101108	" , Rotary 1-1-9	SRM1019-15R-P	
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	"	LC-1-G	
PCB		Printed Circuit Board	3101-07B	
PCB	511310100	"	3101-10B	
	067117110	Spacer	Pファミスペーサ0000	Position
	516100016	Knob φ9mm, Black, with Line	021-222	Position
	516100028	" φ14.5mm, " "	023-342	Range
	516100018	Cap φ9mm, " "	040-162	Position
	516100029	" φ14.5mm, " "	040-362	Range
	516100030	Nut Cover φ14.5mm, Black, with Line	044-322	Range
CR1	G503100035	Di, Zener 6.5V 0.5W ±5%	WZ 065	
CR2	G503100035	" " " "	"	
CR3	G503100007	" " "	WZ 081	
CR4	G503100007	" " " "	"	



Note 1) MARK "." : 25 P.P.M/°C
MARK "Δ" : 100 P.P.M/°C
2) TRIMER R30 Have been set zero ohm.
3) RANGE of AL3102 : "( )"
4) R3 : SHORT

Pre Amplifier Type AL3101-1 AL3102-1

Figure	Part No.	Description				Type	Remarks
R1	G501503301	R, Metal Film	990K	1/2W	±0.25%	RN65E990KC	
R2	501303307	R, "	10K	1/4W	±0.25%	RNE1/4-10KC	
R11	G501810382	R, Metal Film	8.2K	1/4W	±1%	RN1/4-8.2KF	
R12	G504207021	R, Trimmer Cermet		10K		TM10KPH-10K	
R13	501303308	R, Metal Film	4K	1/4W	±0.25%	RNE1/4-4KC	
R14	501303308	R, "	"	"	"	RNE1/4-4KC	
R15	501303309	R, "	12K	1/4W	±0.25%	RNE1/4-12KC	
R16	501303310	R, "	20K	1/4W	±0.25%	RNE1/4-20KC	
R17	501303311	R, "	40K	1/4W	±0.25%	RNE1/4-40KC	
R18	501303312	R, "	120K	1/4W	±0.25%	RNE1/4-120KC	
R19	501303313	R, "	200K	1/4W	±0.25%	RNE1/4-200KC	
R20	501303314	R, "	400K	1/4W	±0.25%	RNE1/4-400KC	
R22	G501810210	R, Metal Film	100	1/4W	±1%	RN1/4-100F	
R23	G501810210	R, "	"	"	"	RN1/4-100F	
R24	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R25	G501810356	R, Metal Film	5.6K	1/4W	±1%	RN1/4-5.6KF	
R26	G501810291	R, "	910K	1/4W	±1%	RN1/4-910F	
R27	G501810282	R, "	820K	1/4W	±1%	RN1/4-820F	
R28	504103015	R, Variable Carbon		20K		RV16YP20SB20K	
R29	G501810382	R, Metal Film	8.2K	1/4W	±1%	RN1/4-8.2KF	
R30	G504207022	R, Trimmer Cermet	2K			TM10KPH-2K	
R31	G501810412	R, Metal Film	12K	1/4W	±1%	RN1/4-12KF	
R32	504103015	R, Variable Carbon		20K		RV16YP20SB20K	
R33	G501810456	R, Metal Film	56K	1/4W	±1%	RN1/4-56KF	
R34	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R35	G501810351	R, "	"	"	"	RN1/4-5.1KF	
R36	G501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R37	G501810339	R, Metal Film	3.9K	1/4W	±1%	RN1/4-3.9KF	
C1	G502303004	C, Myler Film	0.01μ	50WV		MFL-05S1	
C2	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C3	502103023	C, "	"	"		SM25VB-10	
C4	G502303002	C, Myler Film	0.001μ	50WV		MFL-05D1	
C5	502204001	C, Tantalum	6.8μ	16V		CS15E1C6R8M1S-A	
C6	502204001	C, "				"	
C7	502204005	C, "	15μ	16V		CS15E1C150M1S-A	
C8	502204005	C, "				"	
IC1	503300130	IC, OP-Amp FET-Top				LF256	
IC2	A503300054	IC, " Dual				NJM4558D	
S1	508304008	Switch, Slide				SSA042L12	
S2	G508304002	" "				SSA043L12	

Figure	Part No.	Description	Type	Remarks
S3	508304003	Switch, Slide	SSA043L06	
S4	A507101107	" Rotary 1-1-8	M1018-15R-P	
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	"	LC-1-G	
PCB		Printed Circuit Board	3101-07B	
PCB	511310100	"	3101-10B	
	067117110	Spacer	Pツマミスペーサ0000	Position
	516100016	Knob, ϕ9mm, Black, with Line	021-222	Position
	516100028	" ϕ14.5mm, " "	023-342	Range
	516100018	Cap, ϕ9mm, " "	040-162	Position
	516100029	" ϕ14.5mm, " "	040-362	Range
	516100030	Nut Cover, ϕ14.5mm, Black, with Line	044-322	Range
CR1	G503100005	Di, Zener 13V 0.5W ±5%	WZ130	
CR2	G503100005	" " " "	"	
R38	G501810410	R, Metal Film 10K 1/4W ±1%	RN1/4-10KF	

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INSTRUCTION MANUAL

for

LINEARCORDER F

WR3701

SOFERVAL, INC.
33377 Western Avenue
UNION CITY, CALIFORNIA 94587
PLEASE RETURN
FIRST CLASS MAIL

WESTERN GRAPHTEC
WESTERN GRAPHTEC, INC

12 Chrysler Street
Irvine, CA 92718
In California (714) 770-6010
Outside California (800) 854-8385

We would like to take this opportunity to thank you for your purchase of the Linear Coder WR3701. Before using this unit be sure to carefully read this instruction manual. We hope that you will be able to use the WR3701 with pleasure for many years.

We will repair any defects in this device within one year of installation, as long as the problem has not been caused by disasters or by careless use. After this period, maintenance will be according to the maintenance contract.

Study the Following Precautions Carefully Before Using the Unit

Regarding the thermal sensitive paper:
The color development characteristics and surface smoothness of the thermal sensitive recording paper have a great influence over the quality of tracing. Be sure to always use this company's recording paper.

Regarding the pens:
Do not touch the pens with your hand except when replacing them.
Adjust the pen pressure to the lightest amount which will still keep the pen from floating.
The pens can be easily damaged.

Regarding the storage of data:
Due to the fact that the recording paper uses a thermo-chemical reaction, the following precautions must be taken in regards to the handling of recorded data:

1 Do not place the paper in direct sunlight.

2 Do not place the paper in temperatures greater than 50°C.

3 Do not expose the recording paper to light. Exposure to fluorescent or natural light will cause reduction in the recording contrast after a number of months.

4 Do not store the paper in vinyl chloride bags.

5 Do not pile the paper together with wet diazo copy paper.

6 Allowing the paper to come in contact with acid, alcohol, or ester ketone will cause unwanted discoloration.

Regarding protective devices for the pen:
If any of the following conditions occur, the heat source of the pen will be shut off and the signal deflection of the pen will cease, in order to protect the pen tip.

1 If recording paper runs out.

2 If paper feed is stopped by pushing the stop button.

3 If the pen is raised using the pen lift lever.

Precautions regarding mounting of the recording paper:
Mount the recording paper after confirming that the heat switch is OFF.

Regarding high frequency input:
The accuracy of the servos can only be guaranteed when the servo amps are unsaturated. Applying a high frequency input greater than the response speed of the pen and thus saturating the amp is, in principle, undesirable.

Regarding the location of installation:
As this is a highly effective compact unit, adequate attention must be paid to heat dissipation.

Regarding the warning beeper:
When the warning beeper sounds, be sure to depress the white stop button and perform the following operation.

Regarding damping adjustment of the pen motors:
Adjustment by trimmers is possible for each channel from the rear panel. Do not adjust the trimmers except when squarewave characteristics are more important than frequency characteristics. Reducing overshoot for squarewaves will also reduce frequency response.

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1. NAMES AND FUNCTIONS OF THE PARTS

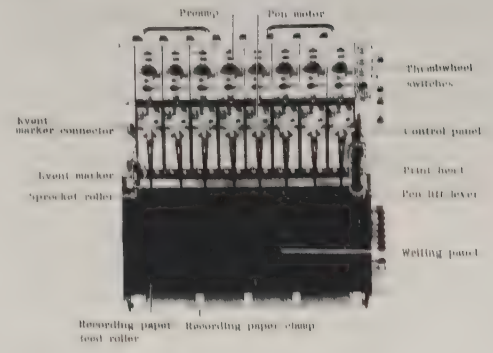


Fig. 1-1 Top view

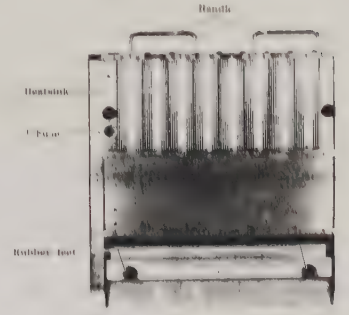


Fig. 1-2 Bottom view

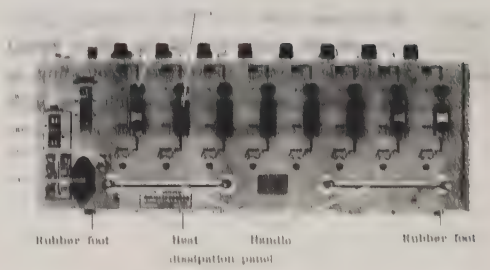


Fig. 1-3 Rear view

1.1 The Top When the Unit is in a Horizontal Position (See Fig. 1-1)

The following are located on the top: 8 channel pen motors, preamp, marker, and the control panel which is located near the print head. Paper clamps are located on the edge of the recording panel.

1.2 The Bottom When the Unit is in the Horizontal Position (See Fig. 1-2)

The fuse is located on the bottom. As the heatsink for the recorder is located here, take care when handling the unit.

1 Fuse

The fuse can be removed by turning it to the left with a Philips screwdriver and then gently pulling it out.

1.3 Rear Side (See Fig. 1-3)

All external connections are made to this area.

2 Protective Grounding Terminal
This terminal connects to the protective grounding wire in order to keep the electric potential of the ground and the metal parts of the cabinet, which are touched, the same.

3 Power Connector
The central conductor of the three wire-type connector receptacle is the protective grounding terminal. Only the special power cables which are included with the unit should be inserted into the receptacle.

4 Input Terminals
These terminals are connected directly to the preamp inputs of the channels which are utilized.

5 External Input Connector for Printing Application
These input terminals receive character signals used for operating the printer from an external keyboard. The terminal arrangement, etc. is explained in Section 4.2.

6 External Control Signal Connector
These connectors are used when recording paper feed, pen heating, and the event marker, etc. are controlled by external signals. This is explained in detail in Section 4.1.

1.4 Control Panel (See Fig. 1.4)

1 POWER ON/OFF

This switch turns the power on and off. Depressing this switch locks it ON and lights the indicator lamp.

2 Power Indictor Lamp (Red)

This lamp lights when the recorder is powered.

3 Thumbwheel Switches

These switches are used for setting to 6 digits the initial period value of hours, minutes, seconds, day, and date printed. The setting method is described in Section 3.3.

4 Printing/Marker Mode Switch

The printing head has both printing and timing functions. This switch is used for selecting the functions. The setting method is explained in Section 3.3

5 CHART EXT

This switch is for paper feeding by external pulse signals; when it is ON, external drive is possible. In the OFF position, the paper is fed at the speed set by the feed range.

6 HEAT

Power is turned off to the heat pens when this switch is in the released position. Depressing the switch will turn on the power to the heat pens. There is no power in the following cases:

- o When paper feed is suspended by depressing the STOP switch.
- o When the pen lift lever is in the up position.
- o When there is no paper.

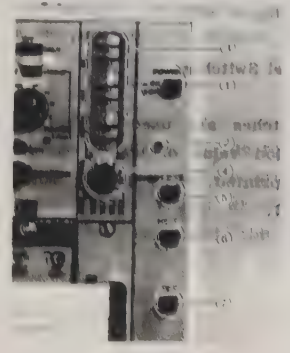


Fig. 1-4a Control panel

7 SET

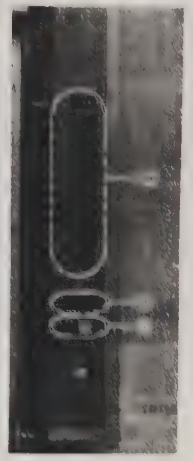
This switch is used when inputting to the printer the month, day, hour, minute, and second information previously set in the thumbwheel switches. The time count is started by this switch according to the timing of the depressed switches.

8 CHART SPEED

This is a selection switch for setting the feed speed of the recording paper. Seven steps are selectable; 1, 2.5, 5, 10, 25, 50, and 100 (mm/min or mm/s). If no switches are depressed the paper will feed at 1 (mm/min or mm/s).

9 SEC/MIN

This switch is used for selecting whether the feed speed range set by the chart speed switches is in seconds or in minutes.



10 STOP

Depressing this switch will lock it down and stop the recording paper feed. In addition to functioning as a start/stop switch for the recording paper feed, it also puts the pen into the free state and shuts off the power to the heat pens.

Fig. 1-4b Control panel

1.5 Recording Paper Feed Section (See Fig. 1-5)

1 Pen Lift Lever

This lever is used when installing paper. Recording paper can be mounted on the rollers after pulling the lever forward. This will raise the pen and move the paper feed rollers.

If the paper feed STOP switch is released when the lever is in the up position, a beeper will sound and no recording activities such as pen deflection will be carried out.

2 Recording Paper Detector

These switches operate when recording paper is not installed. When the paper runs out, the beeper will sound in the same way that it does when the pen lift lever is in the up position. It can be turned off by depressing the STOP switch.

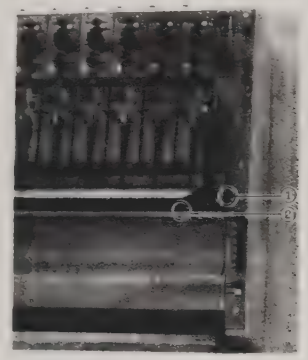


Fig. 1-5 Recording paper feed section

1.6 Preamp (See Fig. 1-6)

This unit multiplies and accurately amplifies the input voltage and supplies it to the pen motor servo amplifier.

1 MEAS/OFF/CAL. V

When this switch is moved to the OFF position, the amplifier is switched from the input terminal to the grounded side; the connection is cut with the external input. When it is moved to the MEAS position, input enters the amplifier circuit. When the switch is moved to the CAL V position, the amplifier input is grounded and an internal voltage causes the pen to deflect 20mm (AL3101, AH3101) or 40mm (AL3102, AH3102).

2 mV/x100mV (mV/V)

When this switch is at the x100mV side, the input voltage to the amplifier is 1/100 (1/1000) of the voltage divider voltage of the input section. In the mV position, the voltage is input directly without being divided.

3 RANGE

When the preamp is AL3101, the following 8 ranges are selectable: 5, 10, 20, 50, 100, 200, 500, and 1000/cm. As an example of this switch's operation in combination with the mV/x100mV switch, when the switch is set to mV, the pen at will have 1cm deflection sensitivity from 5mV at the 5 (/cm) setting. The sensitivity is dependent upon the following GAIN control.

4 GAIN

This is an amplitude control which regulates sensitivity. It can continuously adjust the sensitivity between the ranges. Sensitivity will increase when the knob is turned to the right. When the MEAS/OFF/CAL. V position, adjusting the pen deflection to 20mm (AL3101, AH3101) or 40mm (AL3102, AH3102) will calibrate it to the selected sensitivity of the RANGE dial.

5 POSITION

This control is used for electrically setting the pen to the zero position. The pen can be deflected into any position on the fullscale when the input is zero.

6 Amp Screw Cover

The screws holding the amp in place are located under the cover; moving the cover to the left with your fingernail will allow the screws to be seen. Removing these screws will allow the preamp to be removed.

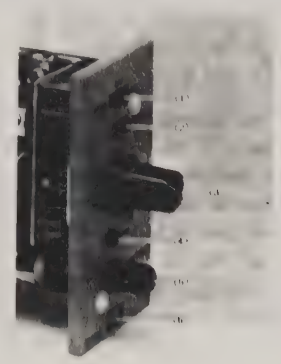


Fig. 1-6 Preamp

1.7 Pen Motor and Marker (See Fig. 1-7)

1 HEAT ON/OFF

Switching this switch off will turn off the power to the heat pen. At the same time, input of the servo amp will be grounded and the connection with the reamp will be cut. This switch is used for setting the pen position while replacing the pens.

2 HEAT CONT

Turning this control to the right will darken the contrast of the recording contrast, turning it to the left will lighten the contrast.

3 Heat Pen

The very small heater located on the tip of the pen generates heat when the power is on and records on the thermosensitive paper.

4 Event Marker

There are two heaters located on the tip of the pen. During normal operations the one on the sprocket side is used to write event marker information.

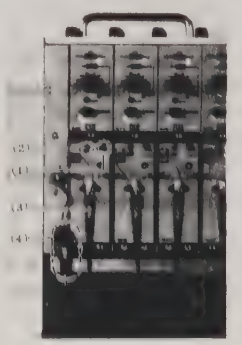


Fig. 1-7 Pen motor and markers

2. PREPARATIONS FOR USE

2.1 Installation of Recording Paper

2.1.1 Recording Paper

The length of the paper is 100m and is divided into areas corresponding to the pen deflection width and number of channels. Recording by black and blue lines is performed by color development resulting from the heaters attached to the tip of the heat pens becoming hot.

1 Great differences exist in color development depending upon the coloring agent and surface finish of the recording paper.

2 The colors of the recording paper will change or become lighter due to thermo-chemical phenomena caused by direct sunlight, storage in high temperatures, or by ultraviolet light.

3 The recording paper is also sensitive to vinyl chloride and diazo-type copying, acid, and alcohol.

Notes:

1. Be sure to use only Graphtec recording paper.

2. Avoid storage and use of the paper in extreme environmental conditions.

3. Do not place the paper on top of a heat-producing device or in a plastic bag together with blueprints.

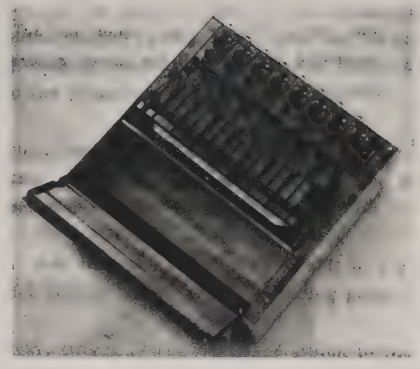


Fig. 2-1 Loading the recording paper

2.1.2 Loading the Recording Paper (See Fig. 2-1)

Open the stocker and place the folding paper together with its box into the mainframe stock section. The folding paper section is divided into two.

Place it so that the large number of channels is to the control panel side.

2.1.3 Setting the Recording Paper (See Fig. 2-2)

1 Pull the pen lift lever on the right side of the mainframe of the recorder forward, allowing the sprocket rollers to be freely rotated, and grasp the edge of the recording paper in both hands. Slide the paper over the panel and pass it through the space between the sprocket rollers. As the paper comes out between the sprocket rollers and the tip of the pen, pull it out by hand and insert it into the sprockets. The sprockets on the left move left and right. Be sure to insert the paper correctly. Lower the pen lift level with the paper pulled out into its proper position (see Fig. 2-2).

2 Place the recording panel back into its previous position and while fitting the panel on to the top of the recording paper, pull the clamp rollers up and feed the paper through.

3 Put the clamp rollers back down.

Note: Be sure the power is turned off while installing paper.

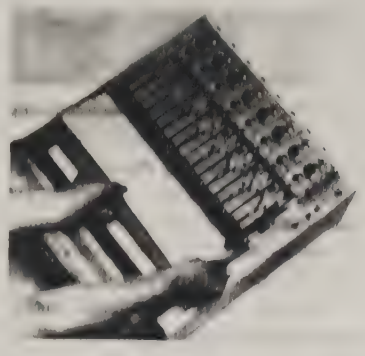


Fig. 2-2 Pulling out the recording paper

2.2 Connecting and Turning on the Power Supply

1 Before turning on the power, be sure that the switches are set as follows

Control panel	CHART EXT: OFF
	HEAT: OFF
	CHART STOP: ON (STOP)
Preamp	MEAS/OFF/CAL.V: OFF
Pen motor	HEAT ON/OFF: OFF

2 Attach the power cable to the connector. When the power supply being used does not have a protective grounding conductor, be sure to attach a ground wire to the protective grounding terminal.

3 Turn the POWER ON/OFF switch to ON. The indicator lamp (red) will light and the pen will deflect slightly and then return to its previous position.

4 In this state set the CHART SPEED to the proper speed and perform a test of the recording paper feed.

5 Next, turn the HEAT ON/OFF switch to the ON position, and release the CHART STOP switch as a low speed. Move the POSITION switch of the preamp and confirm that the pen also moves.

6 Finally, turn the HEAT switch of the control panel to ON and confirm that the pen records a line.

When the above are completed, the power supply is correctly connected and turned on.

2.3 Connecting Input Cables

2.3.1 Preparations for Connection

1 When beginning connection operations, set the switches to the following:

Control panel	POWER ON/OFF: ON
	CHART EXT: OFF
	HEAT: OFF
	PRINT MODE: PRT EXT./STOP
	CHART SPEED: 5mm/s
	STOP: STOP
Preamp	MEAS/OFF: OFF
	RANGE: Optional
	mV/V (mV/x100mV): V (x100mV)
Pen motor	HEAT ON/OFF: OFF

2 Measure the voltage between the input signal source guard terminal GRD (shield side) and the GND terminal of the mainframe to make sure that there is no potential difference between them. If AC voltage is detected, disconnect the unit, search out the source and repair it.

3 Examine the input waveform by another method (for example by CRT oscillograph) to confirm that it does not exceed 500Vp-p and that harmonic noise does not accumulate.

4 Depending upon the type of input, the shorting bar may have to be removed in advance.

2.3.2 Connection by the Input Cable (See Fig. 2-3)

The signal lines should, in principle, be connected using the attached input cables as shown in Fig. 2-3. The surface finish of the other side of the input cable plugs is as follows.

Red: + Terminal
White: - Terminal
Shield wire: GRD terminal

> Note:
>
> There have been cases of signal generators being damaged by installing the included input cables backwards when the shorting bars are attached.

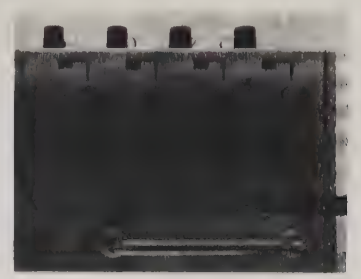


Fig. 2-3 Connection of the input cables

Connection to the signal source is usually performed with the shorting bar attached. GRD and - are connected to the grounded side of the signal source and + is connected to the output side.

The following explanation should be followed for connection under different measurement conditions.

2.3.3 Handling of the GRD (guard) Terminal

The metallic cabinet containing the electronic circuits such as the conditional preamp, etc. is insulated from the mainframe recorder cabinet. An input shield wire is connected into the guard of the input device. It is as if the signal source input cable recorder amplification circuit were surrounded in a metallic cover. It is a noise prevention step necessary when measuring high impedance minute voltages.

During normal measurements, when the output level from the signal source is high, when the impedance between the ground is low, or when the output of a battery-operated device is being measured, the guard is not essential.

Connect the signal source in one of the following ways according to its characteristics.

1 Connect according to Fig. 2-4 for normal signal sources.

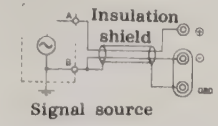


Fig. 2-4

2 When the signal source to be connected has bias voltage, connect as shown in Fig. 2-5 with the low impedance side, as compared to ground, being connected to -.

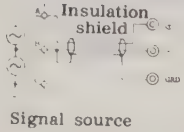


Fig. 2-5

3 A signal source having differential voltage should be connected as in Fig. 2-6. In this case also, the low impedance side is considered as -.

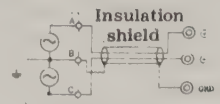


Fig. 2-6

Notes:

1. When the output impedance is high and a low level signal is being measured, the effectiveness of noise elimination will depend upon the suitability of protective grounding, guard, and the connection to the - side signal.

2. It is possible to damage signal generators by shorting their output if the input cables are attached in the opposite direction when the short bar is used. Be sure to connect the cables correctly.

2.3.4 Connection Without Using the Input Cables

The following precautions must be followed when the input cables are not being used.

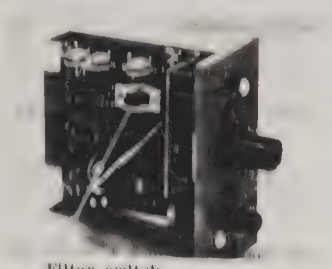
1 Be sure that the - and + signal lines follow the same path. In this way the noise (hum, etc.) in both lines can be balanced, allowing the common-mode rejection of the preamp to operate.

2 If the shield wire of the input cable is used for connection between the signal generator and the protective grounding terminal of the recorder, hum current will pass through the shield wire and create noise. An insulation shield which does pick up unwanted contact potential and hum current must be used. (For example, the included input cables.)

3 Frictional voltage, which can be ignored, will be created by the vibration of the input lines when high-impedance low-level measurements are performed. In addition, drifting will be caused by temperature variation if the input cables are extended by those of a different metal.

2.4 Setting the Noise Filter

If the preamp is removed, a switch having OFF, -20dB, and 40dB written on it can be seen. This switch can set to 20dB or -40dB, when the signal contains a large amount of hum noise, in order to reduce the noise component by 1/10 or 1/100, respectively.

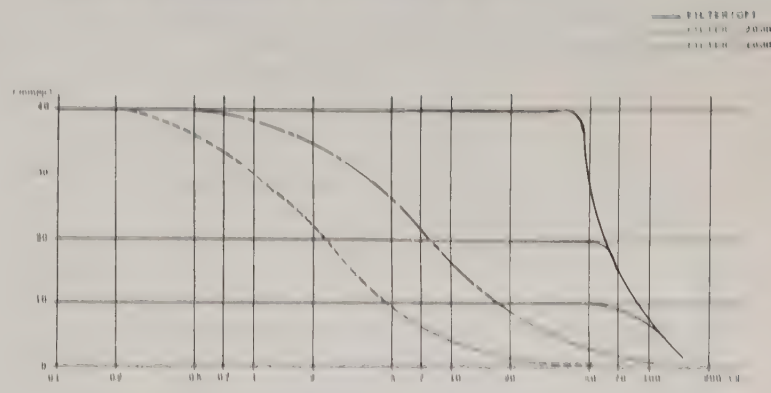


Filter switch

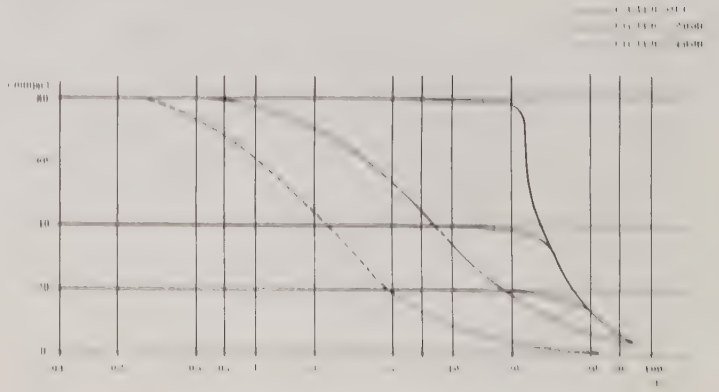
Fig. 2-7 Noise filter switch

2.5 Frequency Characteristics

Frequency characteristics of the GS3701 pen motor



Frequency characteristics of the GW3701 pen motor



3. MEASUREMENT AND RECORDING

3.1 Recording of Waveforms

3.1.1 Simply Recording the Input Waveform on the Recording Paper

Follow the procedure below when only waveform observation is desired, without using the preamp or marker.

1 Set the switches on the control panel to the following to begin with: CHART EXT: OFF, HEAT: OFF, PRINT MODE: PRT EXT/STP, CHART SPEED: 50mm/min, STOP: STOP.

2 Turn the HEAT ON/OFF switch to ON for the channels which are going to be used, turn the POWER ON/OFF switch to ON, and release the STOP switch of the paper feed. The paper will slowly begin to feed and the pen will move to the position determined by the POSITION control.

3 Turn the POSITION knob to move the pen to the proper position and switch the MEAS/OFF control to MEAS; the pen will deflect according to the input signal.

4 Adjust the RANGE dial and mV/x100mV (mV/V) switches to gradually increase the sensitivity and set the deflection width.

5 Switch the CHART SPEED control to the desired speed and immediately turn on the HEAT switch. Recording will begin.

6 When necessary, adjust the contrast of the line by turning the HEAT CONT knob.

Note: When the characteristics of the opening signal are unknown, set the sensitivity starting from the lowest position.

3.1.2 Regulation and Calibration of the Sensitivity

1 When interpolation of the next setting on the RANGE dial is desired, regulate the sensitivity by turning the GAIN knob while the unit is running.

2 When calibration of the amplitude is desired, move the preamp MEAS/OFF CAL.V switch to the OFF position and set the pen to the zero line and move the switch to the CAL.V position. Turn the GAIN knob until the pen deflects 20mm (40mm).

3.2 Operation of the Marker

3.2.1 Event Marker

During external remote operations the event marker records the central marker when short circuited to the GND or when the TTL level is LOW. The baseline is recorded continuously when the circuit is open or when the TTL level is HIGH. Recording will cease when the HEAT switch is turned off.

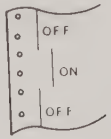


Fig. 3-1 Recording of the event marker

3.2.2 Timing Marker

The recording section is also used as a printing head. To use it as a timing marker, first depress the CHART STOP switch and then set the MODE switch to the prescribed position. The MODE switch can be set to the following positions: 1S, 10S, 1M, 10M, and STOP. Timing will be recorded when the CHART STOP switch is released. Recording will cease when the HEAT switch is turned off.

STOP	Timing will not be recorded.
1S	The timing spacing is 1 second when the feed speed is more than 10mm/s.
10S	The timing spacing is 10 seconds when the feed speed is more than 1mm/s.
1M	The timing spacing is 1 minute when the feed speed is more than 10mm/s.
10M	The timing spacing is 10 minutes.
Note:	Set the MODE switch according to the feed speed. Combinations other than above might result in improper timing.

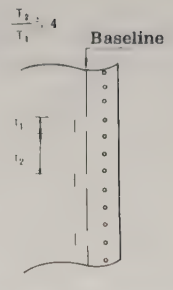


Fig. 3-2 Recording of the timing marker

3.3 Operation of the Printer

3.3.1 Properties of the Printer

1 The control computer can only be cleared by POWER OFF.

2 Printing is possible when the unit is in the PRINT MODE, the HEAT switch is ON, and the CHART STOP switch is released (ON).

3 Switching of the MODE switch is only effective when the CHART STOP switch is ON.

4 The printing operation modes are internal mode and external mode. The former prints the information of thumbwheel switches. The latter prints character information sent by an external digital device.

5 In the internal mode, the information is printed when the paper begins to feed, immediately after data processing ends, and every 450mm after that (approximately).

6 Printing begins immediately in the external mode. The external output is stored in memory when the internal mode information is being printed. The memory contents are printed out consecutively when internal mode printing operations cease.

7 The time and feed speed printed during the internal mode are the same as when printing begins.

Fig. 3-3 MODE switch for printing and timing markers and thumbwheel switches

8 Input CR/LF as the final characters when a character line is input from an external source.

9 When the CHART EXT switch is ON, the paper feed speed will be printed as EXTERNAL and no numerals will be printed.

3.3.2 Setting of the NORMAL Mode

This setting method is for setting the month, day, running time data No., and recording paper feed speed and print information.

1 The running time begins from 00 hours, 00 minutes, 00 seconds when the power is turned on. Time is accumulated while the unit is in operation.

2 Time accumulation begins again from 00 hours, 00 minutes, 00 seconds when the running time exceeds 24 hours.

Operation Procedure

1 The thumbwheel switches are set from the left as follows: Month, day, and data No.

Ex. 4th month, 13th day, data No. 10
[0][4] [1][3] [1][0]

2 Turn the POWER switch to ON.

3 Turn the HEAT switch to ON.

4 Set the CHART SPEED switch (for example, 50mm/s)

The above setting will be printed as follows.
DATE 04.13 TIME 00:00:01 No. 10 SPEED 50mm/s

Note:
The printing contents are just before DATE... Data cannot be changed during printing, so a change means the contents had been changed prior to printing.

3.3.3 Setting of the REAL Mode

This setting method is used for setting month, day, time, data No. and recording paper feed speed print information.

Operation Procedure

1 Turn the STOP switch on (10 on Fig. 1-4, page 3).

2 Turn the POWER switch on.

3 Set the MODE switch to TIME IN.

4 Set the hour minute and second information on the thumbwheel switches.

Ex. 10 hours, 15 minutes, 00 seconds
[1][0] [1][5] [0][0]

5 Depress the SET switch. This will write the hour, minute, and second information into the circuit.

6 Set the MODE switch to DATE IN.

7 Set the month and day information on the thumbwheel switches in the first four digit positions from the left.

Ex. 4th month, 13th day
[0][4] [1][3] [*][*]

* Can be any number from 0 to 9.

8 Depress the SET switch to write the month and day information into the circuit.

9 Set the data No. on the thumbwheel switches in the first two positions from the right.

Ex. data No. 10
[*][*] [*][*] [1][0]

* Can be any number from 1 to 9.

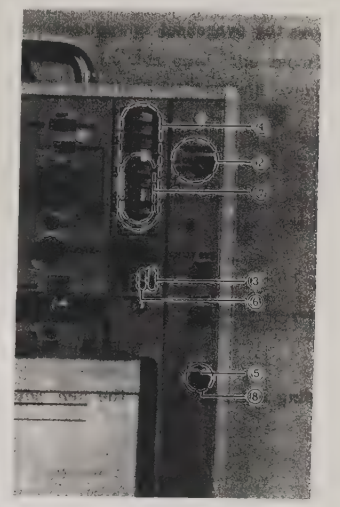
10 Set the MODE switch to the REAL OUT position.

11 Set the CHART SPEED switch. (For example, 50mm/s)

12 Turn the HEAT switch to ON.

The above setting will print out as follows.
DATE 04.13 TIME 10:15:01 No. 10 SPEED 50mm/s

Note:
Changing the data No. will print the changed number.



3.4 Damping Adjustment of the Pen Motors (See Fig. 3-4)

Note:

Do not adjust the unit except when squarewave characteristics are more important than frequency characteristics.

Trimmer for adjustment of each channel are inside holes in the rear panel as is shown in Fig. 3-4. These trimmers can be turned by a standard screwdriver. Overshoot of the input squarewaves can be reduced by rotating the trimmers in the clockwise direction. Frequency characteristics will also be reduced as the overshoot is reduced.

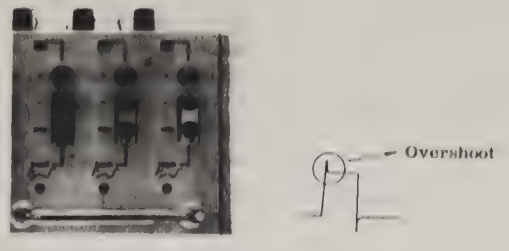


Fig. 3-4 Damping adjustment for the pen motors

3.5 Precautions Regarding Measurement and Recording

The heat pens of this unit are sensitive to overheating. If any of the following situations occur, turn to HEAT OFF immediately and fix the cause:

1 The stepping motor locks.
The folding paper becomes stuck in the stocker and the motor dies not stop pulling. When it becomes locked, the motor will emit an oscillation noise and will stop. The pen will continue to heat, however.

2 The CHART EXT switch is ON but there is no feed pulse being sent from an external source to deflect the pen. In this case, the recording paper will not feed at all and the heat pen will overheat.

3 If, during extremely high-speed use, the recording contrast is raised or if the unit is put into a slow speed, the tip of the pen will overheat.

4. CONTROL USING EXTERNAL SIGNALS

4.1 Control of Recording Operations

4.1.1 Controllable Operations

The following operations can be controlled by external signals.

1 Signal output to indicate the end of recording paper.

2 Control of the event marker.

3 ON/OFF of the heat pen, marker, and printing.

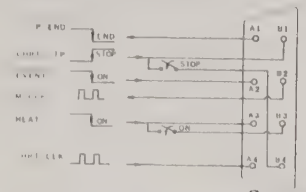
4 Paper feed by external pulse signal

5 Start/stop of paper feed.

6 Pulse signal output for synchronization with another device of paper feed applications.

4.1.2 Signals and Terminal Arrangement of the Connectors

The terminal numbers of the external signal input connectors are shown in Fig. 4-1. Table 4-1 shows their operations. Connector B4 is +5V and connector B3 is connected to GND.



Connector

Fig. 4-1 External control connections

Signal name	Input/output	Operation
$\overline{\text{P.END}}$	Output	Low at end of recording paper end and in pen-up condition.
$\overline{\text{EVENT}}$	Input	Event marker made when shorted to ground or driver to low level.
$\overline{\text{HEAT}}$	Input	Heater on when shorted to ground or driver to low level.
CHRT CLK	Input	Paper feeds when driven with TTL-level pulses (2kHz, 50mm/s maximum)
CHRT STP	Input	Paper feed stops when shorted to +5V (pin B14) or driven to high level.
M.CLK	Output	Outputs paper feed pulse signal; usable in establishing sync with other devices.

Table 4-1

4.1.3 Relation to Internal Controls

$\overline{\text{HEAT}}$ External control is possible when the HEAT switch on the control panel is OFF.

CHRT CLK External control is possible when the EXT switch on the control panel is ON.

CHRT STP External control is possible when the STOP switch on the control panel is OFF (start).

4.1.4 Precautions Regarding External Control Operations

1 When the CHART EXT switch is ON but there is not recording paper feed pulse being sent to deflect the pen, the pen heat will reach a dangerous point as was shown previously.

2 The highest externally generated pulse frequency is 2kHz; 1 Pulse will cause a movement of 0.025mm resulting in a maximum speed of 50mm/s.

3 TTL Low-level signals can be substituted for the contact signals as shown in Fig. 4-1.

4.2 Printer Control From External Devices

4.2.1 Interface

The printer interface of this device is an 8-bit type corresponding to ASCII. The pin numbers of the connectors and the names of the signals are shown in Fig. 4-2. Chart 4-3 is the timing chart. The signals are TTL level.

B		A
BUSY	8	DATA0
$\overline{\text{ACK}}$	7	DATA1
N.C.	6	DATA2
GND	5	DATA3
GND	4	DATA4
$\overline{\text{BUSY}}$	3	DATA5
DATA7	2	DATA6
N.C.	1	STROBE

Fig. 4-2 Connectors of the printer

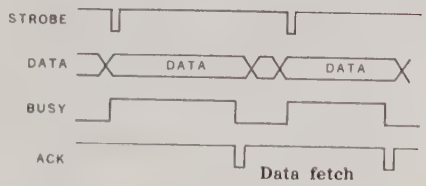


Fig. 4-3 Timing chart of signal transfer in the external mode

4.2.2 General Operations

The input ASCII or kana code character signals are temporarily stored in the memory according to the procedures shown in Fig. 4-4 and Fig. 4-5. They are then printed successively in one line as the paper advances.

1 NORMAL Mode, REAL Mode

In these modes, input data is received from external devices and printed out after the internal data has been printed out according to its format.

2 PRT EXT. Mode

In this mode internal data is not printed out; only the input data from external devices is printed out.

4.2.3 Explanation of the Flow Charts Using Examples

The following are examples regarding the preceeding flowchart.

1 18 characters (terminator): When the buffer becomes full after getting 12 characters, they are printed out. The remaining 6 characters are received and only these 6 characters are printed out.

2 11 characters or less (terminator): The characters up to the terminator are printed out.

3 13 ∿ 23 characters (no terminator): First, the first 12 characters are printed out and the remaining characters enter the buffer memory. These characters are not printed out and no internal mode printing will take place.

4 12 characters or less (no terminator): The characters enter into the buffer memory as data but are not printed and internal mode print out operations also do not take place.

Table 4-2 Code Table

Col / Row	00	...	02	03	04	05	...	11	12	13	...
0	NUL		SP	0	@	P		-			
1	TC_1(SOH)		!	1	A	Q					
2	TC_2(STX)		"	2	B	R					
3	TC_3(ETX)		#	3	C	S					
4	TC_4(EOT)		$	4	D	T					
5	TC_5(ENQ)		%	5	E	U					
6	TC_6(ACK)		&	6	F	V					
7	BEL		'	7	G	W					
8	FE_0(BS)		(	8	H	X					
9	FE_1(HT)		)	9	I	Y					
10	FE_2(LF)		*	:	J	Z					
11	FE_3(VT)		+	;	K	[		¬			
12	FE_4(FF)		,	<	L	¥					
13	FE_5(CR)		-	=	M	]					
14			.	>	N	↑					
15			/	?	O	←					

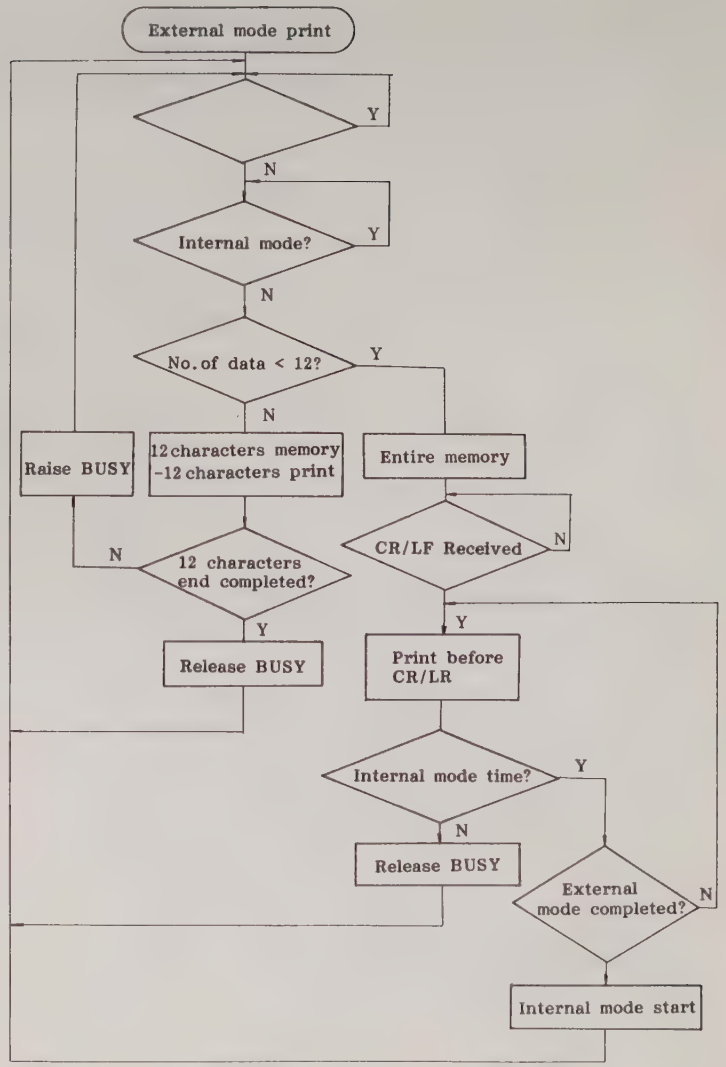


Fig. 4-4 External mode print 1
(NORMAL, REAL)

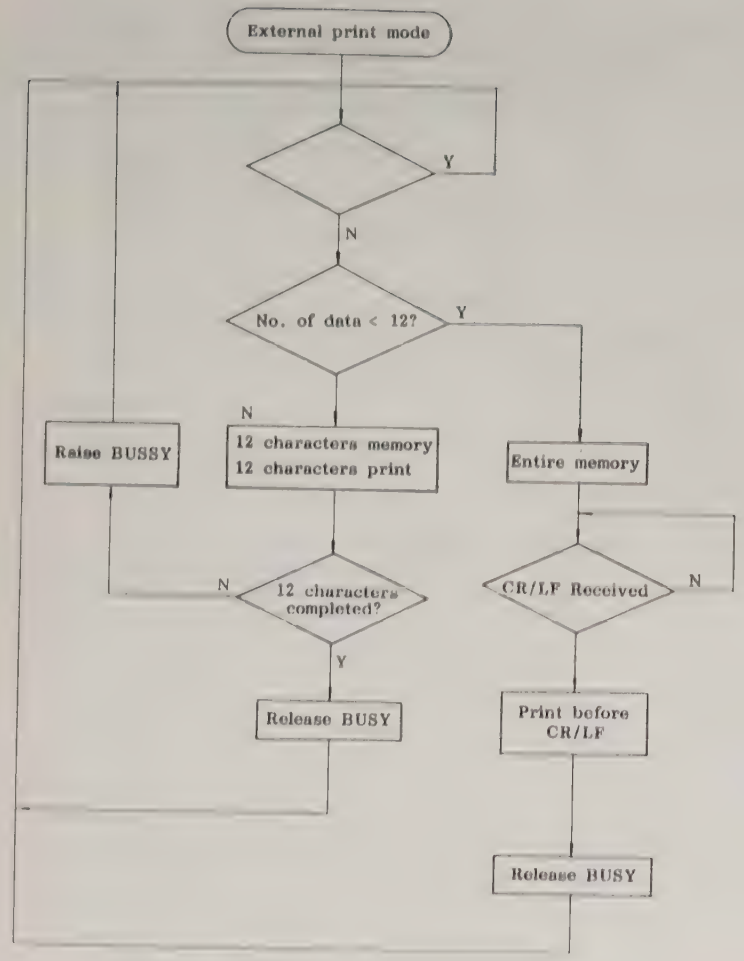


Fig. 4-5 External mode print 2
(PRTIEXT)

5. SPECIFICATIONS

5.1 Mainframe Specifications

Item \ Model	GS3701	GW3701
No. of channels	2/4/6/8/12	1/2/3/4/6
Recording width	±20mm	±40mm
Recording paper	Fanfold 100m	
Recording method	Thermosensitive writing (in black or blue)	
Input type	Floating, guarded ground	
Circuit type	DC Servo	
Input resistance	Potentiometric	
Sensitivity	±2.5V/20mm	±2.5V/40mm
Accuracy	±0.5% of fullscale (including non-linearity & deadband)	
Frequency response (with reference to 1Hz)	10mmp-p: 0 ∿ 70Hz (+5/-10%) 20mmp-p: 0 ∿ 30Hz (+5/-10%) 20mmp-p: 0 ∿ 50Hz (+5/-10%) 40mmp-p: 0 ∿ 25Hz (+5/-10%) 40mmp-p: 0 ∿ 35Hz (+5/-10%) 80mmp-p: 0 ∿ 20Hz (+5/-10%)	
Paper feed speeds	1, 2.5, 5, 10, 25, 50, 100mm/s & min and EXT (50mm/s max.) (Accuracy ±0.2% ±0.5mm)	
Time markers	1 & 10s or 1 & 10min between each mark	
Event marker	Remote control by external contact closure or TTL level signal.	
Remote recording paper feed	Remote on/off control by external contact closure or TTL level signal.	
Remote pen heater	Remote on/off control by external contact closure or TTL level signal.	
Printing	Date, elapsed time, data number & paper feed speed are printed using an internal clock or any alphanumeric string (including symbols) is printed from ASCII input over a Centronix compatible interface.	

Item \ Model	GS3701					GW3701				
Power supply	100VAC ±10% (50/60Hz); 115, 200, 220 and 240VAC available upon request.									
Approx. power consumption LH: 10mmp-p 70Hz DL (DH): 20mmp-p 30Hz	2L(H)	4L(H)	6L(H)	8L(H)	12L(H)	1DL(DH)	2DL(DH)	3DL(DH)	4DL(DH)	6DL(DH)
	160VA	240VA	320VA	400VA	560VA	120VA	160VA	200VA	240VA	320VA
Outer dimensions (±3mm tolerance)	W: 457 H: 197 for all models									
	199(D)	289(D)	379(D)	450(D)	649(D)	199(D)	289(D)	279(D)	450(D)	649(D)
Weight (approx.)	13kg	17kg	23kg	26kg	39kg	11kg	15kg	19kg	22kg	32kg
Operating temperature range	0 ∿ 45°C									
Humidity range	30 ∿ 85% (RH)									

1. Power consumptions & weights include the preamplifier.
2. Time marker/printing is switched.
3. The event marker is optional.

5.2 Preamplifier Specifications

Item \ Model	AL3101-1	AL3102-1	AH3101-1	AH3102-1
Maximum sensitivity	5mV/cm	2.5mV/cm	1mV/cm	0.5mV/cm
Measurement ranges (and switching accuracy)	5, 10, 20, 50, 100, 200, 500, 1000mV 0.5, 1, 2, 5, 10, 20, 50, 100V/cm ±1% (with respect to 500mV/cm range)	2.5, 5, 10, 25, 50, 100, 250, 500mV 0.25, 0.5, 1, 2.5, 5, 10, 25, 50V/cm ±1% (with respect to 500mV/cm range)	1, 2, 5, 10, 20, 50, 100, 200, 500mV 1, 2, 5, 10, 20, 50, 100, 200, 500V/cm ±1% (with respect to 500mV/cm range)	0.5, 1, 2.5, 5, 10, 25, 50, 100, 250mV 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250V/cm ±1% (with respect to 250mV/cm range)
Input type	Floating, guarded ground			
Input resistance	1MΩ (fixed)			
Maximum allowable input voltage	500VDC (including common-mode voltage)			
Sensitivity adjustment	Continuous adjustment between ranges			
Calibration voltage	Measurement range x2 (20mm)	Measurement range x4 (40mm)	Measurement range x2 (20mm)	Measurement range x4 (40mm)
Pen position adjustment	Settable at any position with respect to fullscale			
Common-mode rejection ratio	DC: 130dB, AC: 110dB			
Input filter	Built-in (-20dB/-40dB/OFF, switchable)			
Applicable pen motor	GS3701	GW3701	GS3701	GW3701

5.3 Specifications of External Signal Connector

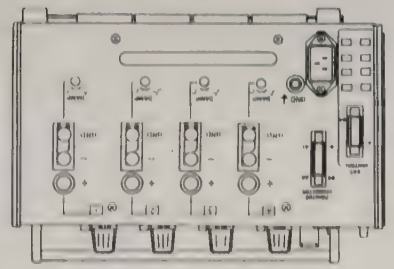
Pin no.	Signal	Input/output type	Input/ output	Specifications
A1	$\overline{\text{PEND}}$	Microswitch	Output	Drives TTL load or equiv.
A2	$\overline{\text{EVENT}}$	4049 (CMOS)	Input	Drive capability of at least CMOS or equiv. is required & contact input is also possible.
A3	$\overline{\text{HEAT}}$	4049	Input	" "
A4	CHRT CLK	4049	Input	Drive capability of at least 1 CMOS or equiv. is required.
B1	CHRT STP	Darlington transistor	Input	Drive capability of at least 1 CMOS or equiv. is required & contact input is also possible.
B2	MCLK	4049	Output	Drives 1 TTL load or equiv.

5.4 Standard Accessories

Description	Qty.	Description	Qty.
Instruction manual	1	Accessory storage bag	1
Recording paper	1 pack	Power cable	1
Input cables	1 for each ch.	*Fuses 4A (4 ∿ 6 channels) 6A (8 ∿ 12 channels)	2
Vinyl cover	1	Printing connector	1
Flatblade screwdriver	1	Remote connector	1
Philips screwdriver	1	L wrenches	1 set

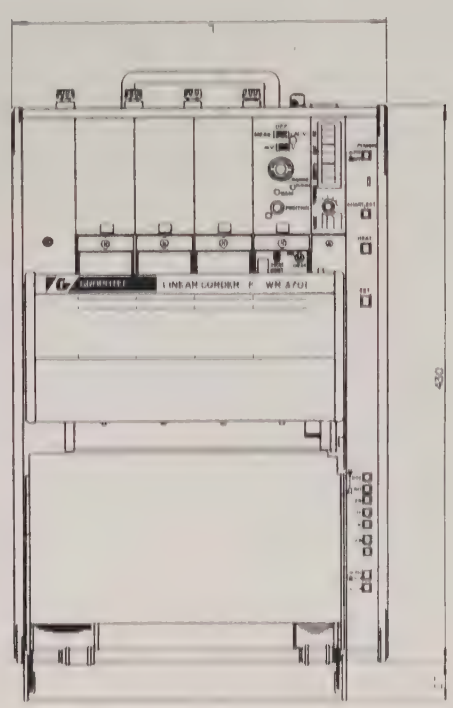
* For 220/240VAC:
2A (4 ∿ 6 channels)
3A (8 ∿ 12 channels)

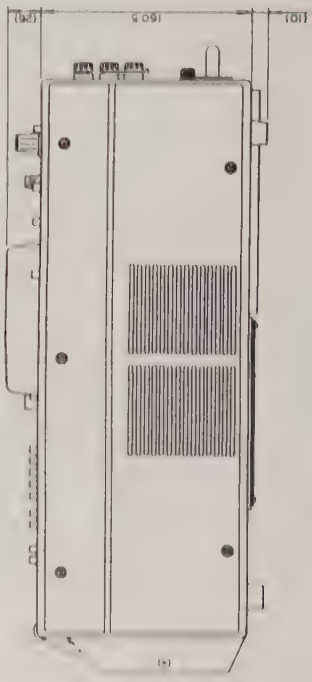
6. EXTERNAL VIEW



Channel number	L
12	649
8	450
6	379
4	289
2	199

Dimension tolerance +5 -1





7. CERTIFICATE OF INSPECTION

This certificate verifies that this unit has passed strict quality control and inspection and that it meets the stated specifications. It was inspected after the circuits had stabilized at room temperature and normal humidity.

Inspector _____

3101P-UM-051

LINEARCORDER

PLUG-IN UNITS

General Description

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UNION CITY, CALIFORNIA 94587
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12 Chrysler Street
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1. INTRODUCTION

A new line of plug-in units has been developed to ensure the most effective use of Linearcorders and bring the recording process closer to the phenomena being measured.

In addition to voltage signal input units, this newly developed line of plug-in units includes DC bridge amplifiers designed for convenient use in strain and stress measurements, suppression amplifiers enabling expanding recording, bias-type amplifier up to 1000% and an F-V conversion amplifier for use in frequency, rpm and vibration measurement applications. All these versatile plug-ins are contained in a single case and are connectable to various transducers to enable compensation and conversion to an electrical signal usable for recording. The compatible plug-in configuration greatly simplifies the task of customizing the Linearcorder for particular recording applications.

2. PLUG-IN UNIT TYPES

	Model		Description	Application
Voltage units	Standard sensitivity	AL3101	Maximum sensitivity 5mV/cm	DC voltage measurement
	"	AL3102	" " 2.5mV/cm	
	High sensitivity	AH3101	" " 1mV/cm	
	"	AH3102	" " 0.5mV/cm	
	Suppression	KZ3101	Maximum sensitivity 10mV/cm Suppression voltage 0 ∿ ±19.99V	
	"	KZ3102	Maximum sensitivity 5mV/cm Suppression voltage 0 ∿ ±19.99V	
	Bias	ALZ3101	Maximum sensitivity 5mV/cm Bias ±1000%	
	"	ALZ3102	Maximum sensitivity 2.5mV/cm Bias ±1000%	
		AZ3101	Maximum sensitivity 1mV/fs Bias ±300%	
	"	AZ3102	Maximum sensitivity 1mV/fs Bias ±300%	
	DC Bridge	KB3101	Maximum sensitivity 0.5mV/cm	Strain measurement
	"	KB3102	" " 0.25mV/cm	
	F-V	KF3101	20Hz ∿ 10kHz	Frequency measurement

3. VOLTAGE UNITS

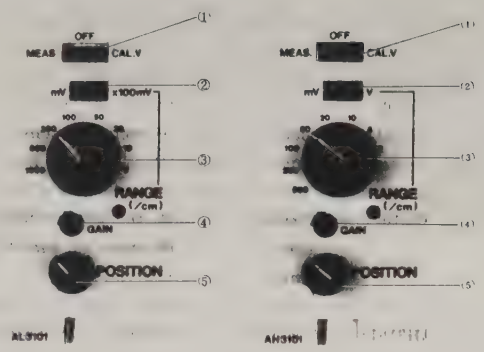
3.1 Introduction

For extremely low-level input signals, it is not possible to deflect the pen sufficiently. To overcome this problem, the voltage units amplify the input signal and provide adeguate deflection for proper recording. Four types, with differing voltage sensitivities and recording amplitudes, are available--AL3101, AL3102, AH3101 and AH3102.

3.2 Specifications

Item \ Model	AL3101	AL3102	AH3101	AH3102
Input type	Floating ground with guard			
Maximum sensitivity	5mV/cm	2.5mV/cm	1mV/cm	0.5mV/cm
Measurement ranges (and switching accuracy)	5, 10, 20, 50, 100, 200, 500, 1000mV 0.5, 1, 2, 5, 10, 20, 50, 100V/cm	2.5, 5, 10, 25, 50, 100, 250, 500mV 0.25, 0.5, 1, 2.5, 5, 10, 25, 50V/cm	1, 2, 5, 10, 20, 50, 100, 200, 500mV 1, 2, 5, 10, 20, 50, 100, 200, 500V/cm	0.5, 1, 2.5, 5, 10, 25, 50, 100, 250mV 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250V/cm
	±1% (with respect to 500mV/cm range)	±1% (with respect to 250mV/cm range)	±1% (with respect to 500mV/cm range)	±1% (with respect to 250mV/cm range)
Input resistance	1MΩ (fixed)			
Sensitivity adjustment	Continuous adjustment between ranges			
Calibration voltage	Measurement range x2 (20mm)	Measurement range x4 (40mm)	Measurement range x2 (20mm)	Measurement range x4 (40mm)
Zero setting	Settable at any position with respect to full scale			
Input filter			Built-in (-20dB/-40dB/OFF, switchable)	
CMRR	DC: 130dB, AC: 110dB		DC: 140dB, AC: 120dB	
Maximum allowable input voltage	500V DC (including common-mode voltage)			
Applicable pen motor	GS3101	GW3101	GS3101	GW3101

3.3 Panel Description and Operation



1 MEAS./OFF/CAL.V

When this input switch is set to MEAS., the input signal is applied, and when set to OFF, the input signal is separated from the input and the input of the unit grounded. In the CAL.V position a calibration voltage equal to 2 times (AL3101 and AH3101) or 4 times (AL3102 and AH3102) the measurement range is applied internally.

2 mV/x100mV (AL3101 and AL3102)

This switch allows selection of 1 or 1/100 as the multiplier for the range selected by the RANGE switch.

2 ' mV/V (AH3101 and AH3102)

This switch is used to select the units for the range, and is used in combination with the RANGE switch in determining the overall measurement range.

3 RANGE

This sensitivity setting switch sets a sensitivity which may be varied using the GAIN control.

AL3101: Combinations with the mV/x100mV switch are used to select 16 steps of sensitivity in the range 5mV ∿ 100V/cm.

AL3102: Combinations with the mV/x100mV switch are used to select 16 steps of sensitivity in the range 2.5mV ∿ 50V/cm.

AH3101: Combinations with the mV/V switch are used to select 18 steps of sensitivity in the range 1mV ∿ 500V/cm.

AH3102: Combinations with the mV/V switch are used to select 18 steps of sensitivity in the range 0.5mV ∿ 250V/cm.

4 GAIN

This continuous sensitivity control, when turned fully clockwise results in the sensitivity indicated by the RANGE switch position being set. The sensitivity is decreased by turning this control in the counterclockwise direction.

5 POSITION

This control is used to adjust the pen zero point.

This zero point adjustment is made with the MEAS./OFF/CAL.V switch in the OFF position.

3.3.1 Operation

(1) Set the MEAS./OFF/CAL.V switch to OFF.

(2) Turn the POSITION control to set the pen position.

(3) Set the mV/x100mV switch (AL3101 and AL3102) or mV/V switch (AH3101 and AH3102) in combination with the RANGE switch to the desired measurement range. If the input is of an unknown level, set the RANGE switch to the extreme counterclockwise position.

(4) Set the MEAS./OFF/CAL.V switch to CAL. V. Turn the GAIN control counterclockwise to decrease the amplitude and clockwise to increase the amplitude. With the GAIN control in the extreme clockwise position, the sensitivity is the setting of the RANGE switch.

(5) Set the MEAS./OFF/CAL.V switch to MEAS. to begin measurements. If the input is of an unknown level, turn the RANGE switch in the clockwise direction from the extreme counterclockwise direction to set the measurement range.

3.3.2 Using the GAIN Sensitivity Adjustment

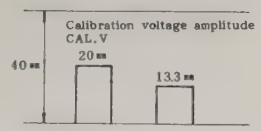
o Setting a Sensitivity Not Marked on the RANGE

Assume that you wish to set full scale of 40mm to correspond to an input of 3V.

(1) Use the RANGE switch to select 500mV/cm sensitivity.

(2) With the MEAS./OFF/CAL.V switch set to CAL.V, turn the GAIN control so that the pen deflection is 13.3mm. The governing equation is as follows.

$$\text{Full scale voltage} = \frac{\text{Range value} \times 2 \times 40\text{mm}}{\text{Deflection in CAL.V position}}$$

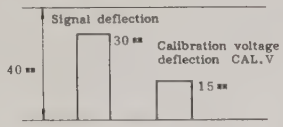


o A calibration voltage equal to 2 times the input sensitivity is applied. Since the input sensitivity is 500mV, the calibration voltage is 1V.

If the deflection with the calibration voltage applied is adjusted to 13.3mm, the full scale (40mm) will be 3V.

o Measuring a Signal of an Unknown Level

Assume a deflection of 30mm by the input signal and a RANGE switch setting of 1V.



o The calibration voltage applied will be 2V (i.e., 2 times the input sensitivity).

Since the signal deflection is twice that caused by the calibration signal, the signal level is 4V.

The governing equation is as follows.

$$\text{Signal level} = \text{RANGE value} \times 2 \times \frac{\text{Signal deflection (div)}}{\text{CAL.V Deflection}}$$

o When measuring a signal it is necessary to switch the MEAS./OFF/CAL.V switch to CAL.V and record the pen deflection before, during and after the measurement.

It is also necessary to record the setting of the RANGE switch as well as that of the mV/x100mV (AL3101 and AL3102) or mV/V (AH3101 and AH3102) switch. The above equation enables the amplitude (voltage) at any point on the recorded waveform to be calculated.

o The above example referred to the AL3101 or AH3101. For the AL3102 or AH3102, the calculation should be made for a full scale of 80mm and a calibration voltage of 4 times the input sensitivity.

4. ZERO SUPPRESSION UNITS

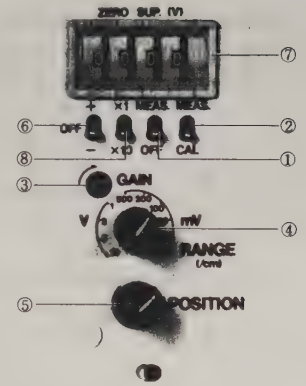
4.1 Introduction

These units are used when measuring signals that are too low in level to provide an adequate pen deflection or signals which have a superimposed DC bias, cancelling out the bias and enabling magnified recording of only the varying component of the input signal. The suppression voltage range is 0 ∿ ±19.99V.

4.2 Specifications

Model	KZ3101	KZ3102
Input type	Floating ground with guard	
Maximum sensitivity	10mV/cm	5mV/cm
Measurement range	10,20,50,100, 200,500mV/cm 1,2,5,10V/cm	5,10,20,50,100, 250mV/cm 0.5,1,2.5,5V/cm
Input resistance	100kΩ (fixed)	
Accuracy	±1% of full scale (including linearity and deadband)	
Sensitivity adjustment	Continuous adjustment between ranges	
Calibration voltage	Switchable voltage 2 times measurement range	Switchable voltage 4 times measurement range
Zero setting	Settable at any position with respect to full scale	
Frequency response	DC ∿ 300Hz (-3dB point of amplifier alone)	
Suppression voltage	x10 Range: 0∿±19.99V x1 Range: 0∿±1.999V (Accuracy: ±0.5 full scale)	
CMRR	130dB (DC), 80dB (50/60Hz)	
Maximum allowable input	120V DC	
Stability	10μV/°C (typical)	

4.3 Panel Description and Operation



1 MEAS./OFF

When this input switch is set to MEAS., the input signal is applied, and when set to OFF, the input signal is separated from the input and the input of the unit grounded.

2 MEAS./CAL

This switch is set to MEAS. during measurements. When set to CAL, a calibration voltage of 2 times (KZ3101) or 4 times (KZ3102) the measurement range is applied to the input internally.

3 GAIN

This continuous sensitivity control, when turned fully clockwise, results in the sensitivity indicated by the RANGE switch position being set. The sensitivity is decreased by turning this control in the counterclockwise direction.

4 RANGE

This sensitivity selection switch enables the selection of sensitivity in 10 steps in the range 10mV ∿ 10V/cm.

5 POSITION

This control is used to adjust the pen zero point.

This zero point adjustment is made with both the MEAS./OFF and MEAS./CAL switch in the MEAS. position.

6 +/OFF/-

This switch enables the suppression voltage to be turned ON and OFF as well as enabling the selection of suppression voltage polarity.

With the switch at the + and - settings, a voltage equal to the voltage set by the ZERO SUP. and x1/x10 switch is superimposed on the input signal with a positive or negative polarity, respectively.

7 ZERO SUP. (V)

This set of digital switches is used in combination with the x1/x10 switch to set the suppression voltage. The units are volts.

8 x1/x10

This switch is used to select the multiplier of suppression voltage set on the ZERO SUP. digital switches to x1 or x10.

4.3.1 Operation

(1) Set the MEAS./OFF switch to OFF and the MEAS./OFF to MEAS.

(2) Turn the POSITION control to set the pen position.

(3) Set the RANGE switch to the desired measurement range.

(4) Set the MEAS./CAL switch to CAL. Turn the GAIN control counterclockwise to decrease the amplitude and clockwise to increase the amplitude. With the GAIN control in the extreme clockwise position, the sensitivity is the setting of the RANGE switch.

(5) Return the MEAS./CAL switch to the MEAS. position.

(6) Set the suppression voltage using a combination of the -/OFF/+, ZERO SUP. and x1/x10 switches.

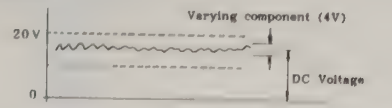
(7) Set the MEAS./OFF switch to MEAS. to begin measurements. If the input is of an unknown level, turn the RANGE switch in the clockwise direction from the extreme counterclockwise position to set the measurement range.

4.3.2 Setting the Suppression Voltage

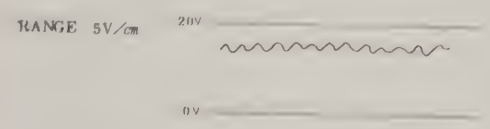
When using the AL or AH voltage unit, the POSITION control is turned to adjust the pen position to up to almost 110% of full scale.

With the KZ units, however, by applying a suppression voltage, it is possible to perform measurements over the range ±(1V x 4) ±19.99V in the 1V/cm sensitivity range.

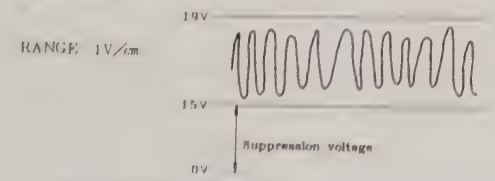
Assume, for example, that the following signal were to be input and recorded.



If an AH or AL unit is used, an input sensitivity setting of 5V would result in the following recording.



However, with the KZ unit, the recording would appear as follows.



If the input sensitivity is set to 1V/cm, too large an input will cause the pen to deflect full scale at the right edge. To avoid this, a suppression voltage is applied to cancel out the DC voltage superimposed on the input waveform, thus enabling magnified recording of only the desired waveform.

5. ±1000% BIAS UNITS

5.1 Introduction

These units are used when measuring signals that are too low in level to provide an adequate pen deflection or signals which have a superimposed DC bias, cancelling out the bias and enabling magnified recording of only the varying component of the input signal. A bias of from -1000% to +1000% of full scale may be applied.

5.2 Specifications

Model	ALZ3101	ALZ3102
Input type	Floating ground with guard	
Maximum sensitivity	5mV/cm	2.5mV/cm
Measurement range	5,10,20,50,100, 200mV/cm 0.5,1,2,5, 10,20V/cm	2.5,5,10,25,50, 100mV/cm 0.25,0.5,1,2.5 5,10V/cm
Input resistance	1MΩ (fixed)	
Maximum signal source resistance	1kΩ	
Zero setting	Settable up to 130% of full scale	
Bias voltage	±1000% of full scale, continuously adjustable using a 10-turn potentiometer provided with a lockable multi-turn indicator.	
Bias voltage setting accuracy	1% for a bias setting of 1000%	

5.3 Panel Description and Operation

1 MEAS./OFF

When this input switch is set to MEAS., the input signal is applied, and when set to OFF, the input signal is separated from the input and the input of the unit grounded.

2 -/0/+

This switch enables the bias voltage to be turned ON and OFF as well as enabling the selection of bias voltage polarity.

With the switch at the + and - settings, a voltage equal to the voltage set by the BIAS control and x1/x10 switch is superimposed on the input signal with a positive or negative polarity, respectively.

3 x1/x100

This switch is used to select the multiplier of bias voltage set by the BIAS control to x1 or x100.

4 BIAS Adjustment

This dual coaxial control is used to set a two-digit value which is used in combination with the setting of the x1/x100 switch to determine the value of bias. The units are % with respect to full scale.

5 RANGE

This sensitivity selection switch enables 12 steps of sensitivity to be selected in the range 5mV ∿ 20V/cm.

6 POSITION

This control is used to adjust the pen zero point.

This zero point adjustment is made with the MEAS./OFF switch in the OFF position.

(Operation)

(1) Set the MEAS./OFF switch to OFF and the -/0/+ switch to 0.

(2) Turn the POSITION control to set the pen position.

(3) Set the RANGE switch to the desired measurement range.

(4) Turn the BIAS control and set the x1/x100 switch to select value of bias in units of % of full scale in the range -1000% to +1000%.

(5) Set the MEAS./OFF switch to MEAS. to begin measurements. Apply a bias of the desired polarity by setting the -/0/+ switch to either - or +.

If the input is of an unknown level, turn the RANGE switch in the clockwise direction from the extreme counterclockwise position to set the measurement range.

6. ZERO BIAS UNIT

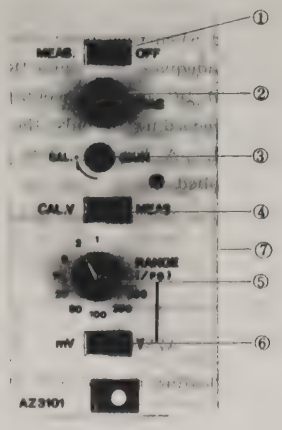
6.1 Introduction

These units are used when measuring signals that are too low in level to provide adequate pen deflection or signals which have a superimposed DC bias, cancelling out the bias and enabling magnified recording of only the varying component of the input signal. A bias of from -300% to +300% of full scale may be applied.

6.2 Specifications

Model	AZ3101	AZ3102
Input type	Floating ground with guard	
Maximum sensitivity	1mV/full scale	
Measurement range	1, 2, 5, 10, 20, 50, 100, 200, 500mV & V/FS	0.5, 1, 2.5, 5, 10, 25, 50, 100, 250mV & V/FS
Accuracy	±0.5% of full scale (including linearity and deadband)	
Input resistance	10MΩ (mV ranges), 20MΩ (V ranges)	
Maximum signal source resistance	10kΩ	
Sensitivity adjustment	Continuous adjustment between measurement ranges.	
Calibration voltage	2 times the measurement range (20mm)	4 times the measurement range (40mm)
Zero setting	Continuously adjustable in the range -300 ∿ +300° of full scale, with manually applied bias.	
Input filter	Switchable: OFF, -20dB, -40dB	
CMRR	DC: 150dB, AC: 130dB (50/60Hz)	
Maximum allowable input voltage	500V DC (including common-mode voltage)	
Stability	0.7μV/°C (Amplifier alone)	

6.3 Panel Description and Operation



1 MEAS./OFF

When this input switch is set to MEAS., the input signal is applied, and when set to OFF, the input signal is separated from the input and the input of the unit grounded.

2 BIAS

This control adjusts the amount of bias applied to the input signal.

Continuous adjustment in the range -300% ∿ +300% of full scale is possible.

3 GAIN

This continuous sensitivity control, when turned fully clockwise, results in the sensitivity indicated by the RANGE switch position being set. The sensitivity is decreased by turning this control in the counter-clockwise direction.

4 CAL.V/MEAS.

This switch is set to MEAS. during measurements. When set to CAL.V, a calibration voltage of 1/2 of the full scale is internally applied.

5 RANGE

This sensitivity selection switch is used in combination with the mV/V switch to enable selection of sensitivity in 18 steps in the range 1mV ∿ 500V/FS. The set sensitivity may be changed by using the GAIN control.

6 mV/V

This switch is used to select the units for the range and is used in combination with the RANGE switch in determining the overall measurement range.

7 OFF/-20dB/-40dB

This is the input filter switch. To use the input filter, set the switch to -20dB or -40dB.

(Operation)

(1) Set the MEAS./OFF switch to OFF and the CAL.V/MEAS. switch to MEAS.

(2) Turn the BIAS control to set the bias in the range -300 ∿ +300 of full scale.

(3) Set the RANGE switch in combination with the mV/V switch to the desired measurement range.

(4) Set the CAL.V/MEAS. switch to CAL.V and turn the GAIN control to adjust the pen amplitude. Turn the GAIN control counterclockwise to decrease the amplitude and clockwise to increase the amplitude. With the GAIN control in the extreme clockwise position, the sensitivity is the setting of the RANGE switch.

(5) Return the CAL.V/MEAS. switch to the MEAS. position and the MEAS./OFF switch to the MEAS. position to start measurements.

If the input is of an unknown level, turn the range switch in the clockwise direction from the extreme counterclockwise direction to set the measurement range. To use the input filter, set the OFF/-20dB/-40dB switch to either -20dB or -40dB.

7. DC BRIDGE UNITS

7.1 Introduction

These units are used in conjunction with strain gauges to enable measurement of strain and stress of materials, machinery and structures.

The input section consists of a strain gauge DC bridge, and an electrical signal which is proportional to the amount of strain in the object being measured.

The input sensitivity range is 0.5mV ∿ 100mV/cm, and for four active gauges, the strain sensitivity may be adjusted between 100×10^{-6}/cm and $20{,}000 \times 10^{-6}$/cm.

These units also feature a resistive balancing function which compensates for resistance variations of gauges and a calibration function which provides resistance variation corresponding to $\pm 1000 \times 10^{-6}$ strain in an active gauge.

This calibration function is suitable for use with 120Ω and 350Ω gauges.

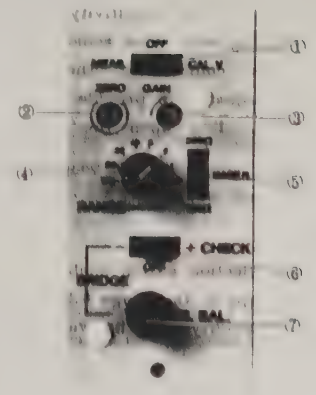
3V output is available for use as the excitation voltage for DC bridges.

* The DC bridge amplifier input terminals are different than the normal 3-pin terminals. Please indicate this when ordering DC bridge units.

7.2 Specifications

Model	KB3101	KB3102
Input type	Floating ground with guard	
Measurement range	0.5, 1, 2, 5, 10, 20, 50, 100mV/cm	0.25, 0.5, 1, 2.5, 5, 10, 25, 50mV/cm
Accuracy	±1% of full scale (including linearity and deadband)	
Input resistance	200kΩ (fixed)	
Sensitivity adjustment	Continuous adjustment between ranges.	
Calibration voltage	Switchable voltage 2 times measurement range	Switchable voltage 4 times measurement range
Zero setting	Settable to any position with respect to full scale	
Frequency response	DC ∿ 300Hz (-3dB points of amplifier alone)	
Excitation voltage	3V DC ±0.5%	
Balance control	Resistive balance ±0.5%	
Shunt calibration	+/OFF/- Switch is used to apply a resistance to one leg of the bridge corresponding to 1000×10^{-6} strain (suitable for 120Ω and 350Ω bridges).	
CMRR	100dB (DC), 80dB (50/60Hz)	
Maximum allowable input voltage	12V DC (p-p)	
Stability	5μV/°C (typical)	

7.3 Panel Description and Operation



1 MEAS./OFF/CAL.V

When this input switch is set to MEAS., the input signal is applied, and when set to OFF, the input signal is separated from the input and the input of the unit grounded. In the CAL.V position, a calibration voltage equal to 2 times (KB3101) or 4 times (KB3102) the measurement range is applied internally.

2 ZERO

This control is used to adjust the pen zero point.

This zero point adjustment is made with the MEAS./OFF/CAL.V switch in the OFF position.

3 GAIN

This continuous sensitivity control, when turned fully clockwise, results in the sensitivity indicated by the RANGE switch being set. The sensitivity is decreased by turning this control in the counterclockwise direction. It is adjusted to provide an easy reading of strain value, depending upon the number of gauges used.

4 RANGE

This sensitivity selection switch enables the selection of sensitivity in 8 steps in the range 0.5mV ∿ 100mV/cm.

The set sensitivity may be varied by using the GAIN control.

5 GAUGE.R

This switch is set to the resistance of the gauge used, either 350Ω or 120Ω.

6 CHECK

This switch is used to apply a resistance change to one leg of the bridge equivalent to 1000×10^{-6} strain. This is used for calibration purposes.

This calibration function is used with the GAUGE.R switch set to either 120Ω or 350Ω, depending upon the type of gauge used.

For 120Ω gauges, 60.4kΩ is connected and for 350Ω gauges, 174kΩ is connected, the resulting strain being equivalent to 1000×10^{-6} strain (i.e., a bridge output of 1.5mV).

Polarity switching of +/- is possible, enabling calibration for both expansion and compression. This switch is placed in the OFF position during measurements.

7 R. BAL.

This control is used to compensate for the initial imbalance caused by variations between the gauge and dummy resistances making up the bridge.

(Operation)

(1) Connect the gauge to the input terminals. (Refer to the examples of bridge configurations and output voltages.)

(2) Set the MEAS./OFF/CAL.V to OFF.

(3) Use the ZERO adjustment to set the pen position.

(4) Set the RANGE switch to the desired measurement range.

(5) With the MEAS./OFF/CAL.V switch set to CAL.V, turn the GAIN control to adjust the pen amplitude. Turn the GAIN control counterclockwise to decrease the amplitude and clockwise to increase the amplitude. With the GAIN control in the extreme clockwise position, the sensitivity is the setting of the RANGE switch.

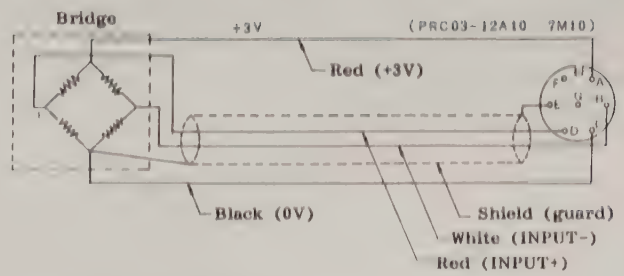
(6) Set the GAUGE.R switch to either 120Ω or 350Ω, depending upon which type of gauge is being used.

(7) Set the MEAS./OFF/CAL.V to MEAS. and the CHECK switch to either the + or −. Depending upon the bridge configuration, the appropriate calibration voltages will be input.

Adjust the R. BAL control to compensate for initial imbalance.

(8) Set the CHECK switch to OFF and the MEAS./OFF/CAL.V to MEAS. to begin measurements.

7.4 Input Connections



Pin	Signal
A	+3V
B	INPUT-
C	0V
D	INPUT+
E	Guard
F	NC
G	NC

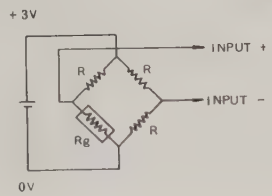
o To avoid induced noise, the outside shield should be connected to 0V at the bridge side.

7.5 Bridge Configuration and Output Voltage Examples (For a Gauge Ratio of 2)

7.5.1 Single Gauge

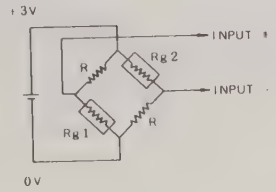
R_g: Gauge resistance
R: Fixed resistance

Strain	Output voltage
$1000x10^{-6}$	1.5mV



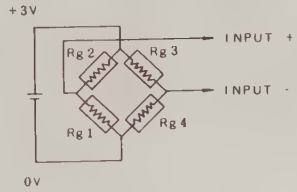
7.5.2 Two Gauges (With R_{g1} and R_{g2} resistance changes in the same direction)

Strain	Output voltage
$1000x10^{-6}$	3mV



7.5.3 Four Gauges (Resistance changes R_{g1} & R_{g3} and resistances R_{g2} & R_{g4} in the same direction, with R_{g1} & R_{g2} and R_{g3} & R_{g4} in the reverse direction)

Strain	Output voltage
$1000x10^{-6}$	6mV



8. F-V UNIT

8.1 Introduction

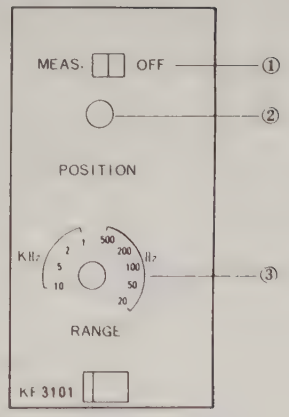
This frequency measuring unit accepts a pulse signal as its input.

In addition to frequency measurement, it is usable in a wide variety of applications, including rpm and vibration measurements.

8.2 Specifications

Model	KF3101
Input type	0.5V p-p or greater AC
Maximum sensitivity	20Hz/FS
Measurement range	20, 50, 100, 200, 500Hz/FS 1, 2, 5, 10kHz/FS
Input resistance	100kΩ (fixed)
Calibration reference	10kHz
Zero setting	Settable up to 50% of full scale
Linearity	±0.5%/FS
Ripple	1.5% (20Hz)
Response time	0.6s/FS
Maximum allowable input	200V p-p

8.3 Panel Description and Operation



1 MEAS./OFF

When this input switch is set to MEAS., the input signal is applied and when set to OFF, the input signal is separated from the input and the input of the unit grounded.

2 POSITION

This control is used to adjust the pen zero point.

This zero point adjustment is made with the MEAS./OFF switch in the OFF position.

3 RANGE

This sensitivity selection switch enables 9 steps of sensitivity to be selected in the range 20Hz ∿ 10kHz/FS.

8.3.1 Operation

(1) Set the MEAS./OFF to OFF.

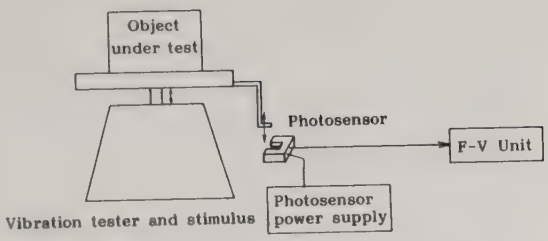
(2) Turn the POSITION control to set the pen position to the left edge.

(3) Set the RANGE switch to the desired measurement range.

(4) Set the MEAS./OFF switch to MEAS. to begin measurement.

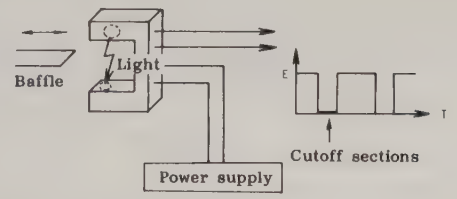
8.3.2 Application Examples

(1) Vibration Measurement



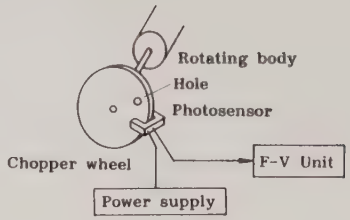
When using vibration testers and accelerator sources to perform vibration tests, the vibration frequency can be converted to a pulse signal using a photosensor or other device to enable direct recording.

The photosensor consists of a light-emitting and light-receiving element pair. The alternate impinging and blockage of light from the light receiver results in a pulse signal output.



(2) Rpm Measurement

A chopper with a hole is mounted onto the rotating body to be measured to enable measurement of rpm. With a single hole in the chopper wheel, the rotating speed will be in units of rps (revolutions per second). If a wheel with 60 holes is used, the units become rpm (revolutions per minute).



9. HIGH-VOLTAGE ISOLATION AMPLIFIERS

9.1 Introduction

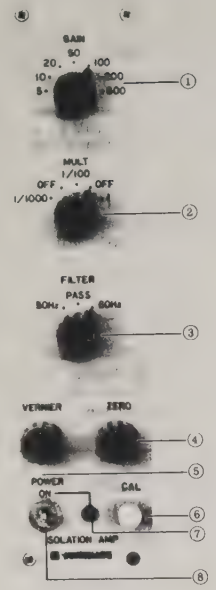
This amplifier provides high-voltage isolation and ensures safety in recording. In addition to enabling safe use of a linearcorder in measuring high voltage in such applications as steel production lines, it may be used with other recorders to provide high-voltage isolation and amplification.

9.2 Specifications

Model	KI3101
Input type	Floating
Input resistance	1MΩ (fixed)
Gain	x1/1000, 1/100, 1, 5, 10, 20, 50, 100, 200, 500
Accuracy	±1%
Frequency accuracy	+5%, -10% DC ∿ 2kHz, output of 10V p-p
Lowpass filter	5, 10, 20, 50, 100, 200, 1kHz, 2kHz (8 steps), -18dB/octave rolloff
Voltage measurement range	1mV ∿ 800V p-p (AC or DC)
Maximum allowable input voltage	±800V (DC or AC peak value)
CMRR	80dB (AC or DC)
Stability	20μV/°C, 200μV/10H ±200μV/ 100V AC ±15%

Model	KI3101
Output voltage	±10V, 5mA
Linearity	±0.1%/FS
Noise	15μV p-p or less
Isolation	Power supply to case: 10MΩ or greater measured with a 1000V DC megohm meter
Withstanding voltage	Input to case: 2500V AC for 1 minute Input to case: 1500V AC for 1 minute
Operating environment	0 ∿ 45°C, 30 ∿ 85% RH
Power supply	100V AC ±10%
Input filter	OFF/-40dB (50/60Hz) switchable
Sensitivity adjustment	Continuous adjustment between ranges
Zero setting	±120% of output voltage
Expandability	Up to 6 channels of single units connectable
Outer dimensions	66 x 450 x 250mm

9.3 Panel Description



1 GAIN

Amplifier gain selection switch.

2 MULT

Gain multiplier selection switch. This switch is used in combination with the GAIN switch setting to determine the overall amplifier gain. In the OFF position, the input is switched off.

3 FILTER

50/60Hz bandpass filter switch. Used to eliminate induced noise from the power line.

4 ZERO

This control is used to set the amplifier zero point.

5 VERNIER

This is a continuous gain control.

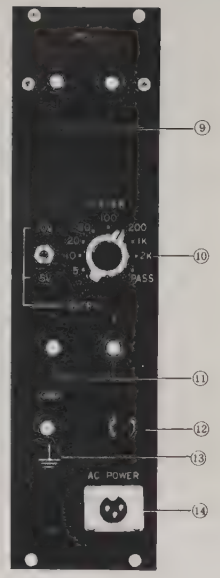
6 CAL

This switch outputs a calibration voltage. The gain is adjusted by pressing this switch and adjusting the VERNIER control.

7 Power Lamp

8 POWER

This is the amplifier power on/off switch.



9 INPUT

Input terminals.

10 FILTER

This switch selects the lowpass filter cutoff frequency.

11 OUTPUT

Output terminals.

12 FUSE

Fuse holder. A 0.5A fuse is used.

13 GND

Ground terminal. This terminal is internally connected to the case.

14 AC POWER

Power connector.

9.4 Operation

(1) Start Up

Plug in the power connector and set the POWER switch to ON.

(2) Signal Connections

Make signal connections to the rear panel input terminals and output terminals.

(3) Gain Setting

Use the GAIN switch and MULT switch to set the desired gain.

(4) Gain Calibration

Press the CAL switch and adjust the VERNIER control so that the output varies 10V. In this condition, the actual gain is that which is indicated on the panel.

(5) Filter

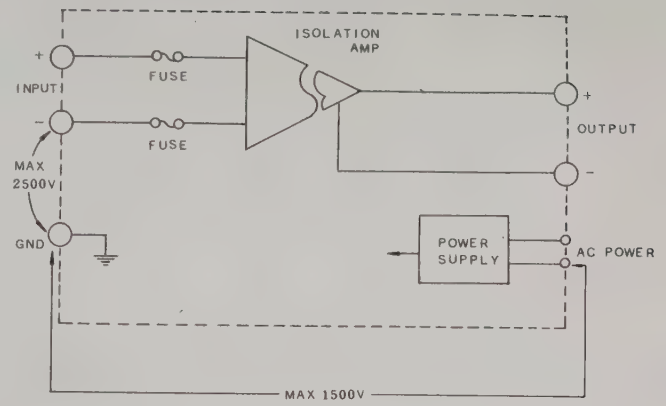
Induced noise from the power line may be eliminated by using the FILTER switch on the front panel.

The rear panel FILTER switch is used to insert a -18dB/octave rolloff lowpass filter.

(6) Zero Point Adjustment

Set the MULT switch to OFF and turn the ZERO control to adjust the amplifier zero point.

9.5 Circuit Configuration



9.6 Precautions for Measurements

9.6.1 Maximum Allowable Input Voltage

The maximum allowable input voltage will differ, depending upon the MULT switch setting.

MULT	Maximum allowable input voltage
1	10V
1/100	1000V
1/1000	1500V

9.6.2 Withstanding Voltage

It should be remembered that the maximum withstanding voltages of this unit are as shown in Section 9.5 (Circuit Configuration).

ACCOPRESS®

25170	YELLOW
25171	BLACK
25172	LIGHT BLUE
25173	DARK BLUE
25174	LIGHT GRAY
25175	LIGHT GREEN
25176	DARK GREEN
25177	TANGERINE
25178	RED
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